PROJECT MANUAL
FOR

CLIENT
CITY OF CIBOLO
ANIMAL SERVICES FACILITY
CIBOLO, TEXAS

9/14/26
100% PERMIT / BID SET
QAI PROJECT #25030

ARCHITECT
QUORUM ARCHITECTS, INC.
825 WEST VICKERY BOULEVARD, SUITE 100
FORT WORTH, TX 76104
CONTACT: KIM DOWDY-HICKMAN, EMAIL: KIMD@QARCH.COM; PH: 817-546-6325



David Duman
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END OF SECTION 00 01 07

Architectural Design:
David G. Duman, AIA
825 W. Vickery Blvd Suite 100
Fort Worth, TX 76104
817.546.6315



David Duman
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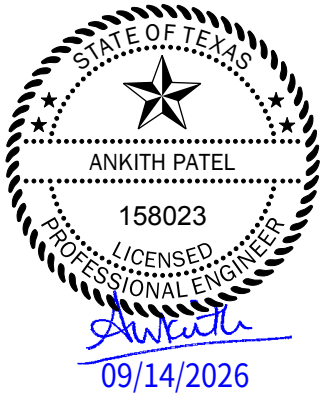
Mechanical Design:
Leslie R. Brown, P.E.
Baird, Hampton, & Brown
6300 Ridglea Place, Suite 700
Fort Worth, TX 76116
817.253.0069



Electrical Design:
Paul Morris, P.E.
Baird, Hampton, & Brown
6300 Ridglea Place, Suite 700
Fort Worth, TX 76116
682.348.0762



Structural Design:
Ankith Patel, P.E.
IMEG | formerly JQ Engineering
15810 Park Ten Place, Suite 225
Houston, TX 77084
713.458.7684



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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification of project team members and their contact information.

1.02 OWNER:

A. Name: City of Cibolo
   1. Address Line 1: 240 Haeckerville Road.
   2. City: Cibolo.
   3. State: Texas.
   4. Zip Code: 78108.

B. Primary Contact: All correspondence from the Contractor to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Title: Principal/Director of Animal Care Design.
   2. Name: Kim Dowdy-Hickman.
   3. Email: kimd@qarch.com.

1.03 CONSULTANTS:

A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Company Name: Quorum Architects Inc.
      a. Address Line 1: 825 W. Vickery Blvd, Suite 100.
      b. City: Fort Worth.
      c. State: Texas.
      d. Zip Code: 76104.
   2. Primary Contact:
      a. Title: Principal/Director of Animal Care Design.
      b. Name: Kim Dowdy-Hickman.
      c. Email: kimd@qarch.com.

B. Civil Engineering Consultant:
   1. Company Name: Kimley-Horn & Associates.
      a. Address Line 1: 10101 Reunion Pl Ste 400.
      b. City: San Antonio.
      c. State: Texas.
      d. Zip Code: 78216.

C. Landscape Architecture Consultant:
   1. Company Name: Kimley-Horn & Associates.
      a. Address Line 1: 10101 Reunion Pl Ste 400.
      b. City: San Antonio.
      c. State: Texas.
      d. Zip Code: 78216.

D. Structural Engineering Consultant:
   1. Company Name: IMEG Engineers.
      a. Address Line 1: 15810 PARK TEN PLACE, SUITE 225.
      b. City: HOUSTON.
      c. State: Texas.
      d. Zip Code: 77084.

E. Mechanical Engineering Consultant
   1. Company Name: Baird Hampton Brown Engineers.
      a. Address Line 1: 6300 Ridglea Place, Suite 700.
      b. City: Fort Worth.

c. State: Texas.
d. Zip Code: 76116.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 00 01 03

PROCUREMENT AND CONTRACTING REQUIREMENTS

2.01 DIVISION 00 - FRONT END DOCUMENTS/COMPETITIVE SEALED PROPOSAL DOCUMENTS BY OWNER

2.02 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 01 - Project Title Page

00 01 03 - Project Directory

00 01 07 - Seals Page

00 31 00 - Available Project Information

00 43 23 - Alternates Form

SPECIFICATIONS

3.01 DIVISION 01 -- GENERAL REQUIREMENTS

A. 01 10 00 - Summary

B. 01 23 00 - Alternates

C. 01 25 00 - Substitution Procedures

D. 01 30 00 - Administrative Requirements

E. 01 32 16 - Construction Progress Schedule

F. 01 40 00 - Quality Requirements

G. 01 42 16 - Definitions

H. 01 42 19 - Reference Standards

I. 01 50 00 - Temporary Facilities and Controls

J. 01 52 13 - Field Offices and Sheds

K. 01 57 13 - Temporary Erosion and Sediment Control

L. 01 57 19 - Temporary Environmental Controls

M. 01 60 00 - Product Requirements

N. 01 70 00 - Execution and Closeout Requirements

O. 01 71 23 - Field Engineering

P. 01 78 00 - Closeout Submittals

Q. 01 79 00 - Demonstration and Training

R. 01 91 13 - General Commissioning Requirements

3.02 DIVISION 02 -- EXISTING CONDITIONS

3.03 DIVISION 03 -- CONCRETE

A. 03 05 16 - Underslab Vapor Barrier - Stego Industries

B. 03 10 00 - Concrete Forming and Accessories

C. 03 30 00 - Cast-in-Place Concrete

D. 03 35 00 - Concrete Floor Finishing

3.04 DIVISION 04 -- MASONRY

A. 04 05 11 - Masonry Mortaring and Grouting

B. 04 20 00 - Unit Masonry

C. 04 26 13 - Masonry Veneer

D. 04 29 00 - Engineered Unit Masonry

E. 04 72 00 - Cast Stone Masonry

3.05 DIVISION 05 -- METALS

A. 05 12 00 - Structural Steel Framing
B. 05 12 13 - Architecturally-Exposed Structural Steel Framing
C. 05 31 00 - Steel Deck
D. 05 40 00 - Cold-Formed Metal Framing
E. 05 51 00 - Metal Stairs

3.06 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES

A. 06 10 00 - Rough Carpentry
B. 06 20 00 - Finish Carpentry
C. 06 64 00 - Plastic Paneling
D. 06 83 16 - Fiberglass Reinforced Paneling

3.07 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

A. 07 05 43 - Cladding Support Systems
B. 07 17 16 - Bentonite Composite Sheet Waterproofing
C. 07 19 00 - Water Repellents
D. 07 21 00 - Thermal Insulation
E. 07 21 19 - Foamed-In-Place Insulation
F. 07 24 00 - Exterior Insulation and Finish Systems
G. 07 41 13 - Metal Roof Panels
H. 07 42 13 - Metal Wall Panels
I. 07 52 00 - Modified Bituminous Membrane Roofing
J. 07 62 00 - Sheet Metal Flashing and Trim
K. 07 71 23 - Manufactured Gutters and Downspouts
L. 07 72 00 - Roof Accessories
M. 07 84 00 - Firestopping
N. 07 92 00 - Joint Sealants

3.08 DIVISION 08 -- OPENINGS

A. 08 11 13 - Hollow Metal Doors and Frames
B. 08 16 13 - Fiberglass Doors
C. 08 36 13 - Sectional Doors
D. 08 43 13 - Aluminum-Framed Storefronts
E. 08 62 23 - Tubular Skylights
F. 08 71 00 - Door Hardware
G. 08 80 00 - Glazing

3.09 DIVISION 09 -- FINISHES

A. 09 21 16 - Gypsum Board Assemblies
B. 09 30 00 - Tiling
C. 09 51 00 - Acoustical Ceilings
D. 09 65 00 - Resilient Flooring
E. 09 67 00 - Fluid-Applied Flooring

F. 09 68 13 - Tile Carpeting
G. 09 72 00 - Wall Coverings
H. 09 83 00 - Acoustic Finishes
I. 09 90 00 - Painting and Coating - Commercial Facility Guide Specification - Sherwin-Williams
J. 09 91 13 - Exterior Painting

3.10 DIVISION 10 -- SPECIALTIES

A. 10 11 00 - Visual Display Units
B. 10 14 16 - Plaques
C. 10 14 19 - Dimensional Letter Signage
D. 10 14 23 - Panel Signage
E. 10 26 00 - Wall and Door Protection
F. 10 28 00 - Toilet, Bath, and Laundry Accessories
G. 10 73 16.23 - Fabric Canopies

3.11 DIVISION 11 -- EQUIPMENT

3.12 DIVISION 12 -- FURNISHINGS

A. 12 24 00 - Window Shades
B. 12 36 00 - Countertops

3.13 DIVISION 13 -- SPECIAL CONSTRUCTION

3.14 DIVISION 14 -- CONVEYING EQUIPMENT

3.15 DIVISION 21 -- FIRE SUPPRESSION

21 00 10 - Basic Fire Protection Requirements
21 05 12 - Fire Protection and Electrical Coordination
21 11 00 - FIre Protection Piping
21 13 00 - Automatic Sprinkler System

3.16 DIVISION 22 -- PLUMBING

22 00 10 - Basic Plumbing Requirements
22 05 12 - Plumbing and Electrical Coordination
22 05 19 - Plumbing Meters and Gauges
22 05 29 - Plumbing Supports and Anchors
22 05 53 - Plumbing Identification
22 05 93 - Plumbing Testing, Adjusting and Balancing
22 07 16 - Plumbing Piping Insulation
22 10 00 - Plumbing Piping
22 10 01 - Plumbing Specialties
22 11 19 - Piping Specialties
22 30 00 - Plumbing Equipment
22 40 01- Plumbing Fixtures

3.17 DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 10 - Basic Mechanical Requirements
23 05 12 - Mechanical and Electrical Coordination
23 05 53 - Mechanical Identification

23 05 93 - Mechanical Testing, Adjusting and Balancing
23 07 13 - HVAC Duct Insulation
23 23 00 - Refrigerant Piping
23 31 13 - Metal Ductwork
23 31 13.19 - Ductwork Accessories
23 34 00- Fans
23 37 13 - Air Outlets and Inlets
23 75 33 - Outside Air Handling Units
23 81 27 - Ductless Split Air Conditioning Units
23 81 50 - Variable Refrigerant Flow System
23 89 65 - Motor Controllers

3.18 DIVISION 24 -- RESERVED (NOT USED)

3.19 DIVISION 26 -- ELECTRICAL

26 05 10 - General Requirements for Electrical Work
26 05 19 - Wires and Cables
26 05 20 - Wire Connection and Devices
26 05 20 - Grounding
26 05 27 - Sealing of Penetrations
26 05 29 - Supporting Devices
26 05 32 - Pull and Junction Boxes
26 05 33 - Conduits
26 05 34 - Outlet Boxes
26 05 35 - Wireway
26 05 36 - Cable Tray
26 09 24 - Occupancy sensors
26 09 26 - Miscellaneous Items
26 09 27 - Lighting Control System
26 24 16 - Panelboards
26 24 17 - Distribution Panelboards
26 25 51 - Generator Docking Station
26 27 16 - Cabinets
26 27 26 - Wiring Devices
26 28 16 - Overcurrent Protective Devices
26 28 17 - Disconnect Switches
26 32 13 - Diesel Generator System
26 36 23 - ONAN-Automatic Transfer Switches
26 43 13 - Surge Protection Devices (SPDs)
26 51 13 - Lighting

3.20 DIVISION 27 -- COMMUNICATIONS

27 05 28 - Empty Conduit Systems

3.21 DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY

28 31 05 - Intelligent Reporting Fire Detection System - Silent Knight

3.22 DIVISION 31 -- EARTHWORK

A. 31 10 00 - Site Clearing

B. 31 23 16 - Excavation

C. 31 23 16.13 - Trenching

D. 31 23 23 - Fill

3.23 DIVISION 32 -- EXTERIOR IMPROVEMENTS

32 18 13 - Synthetic Grass Surfacing

32 31 13 - Chain Link Fences and Gates

32 31 19 - Decorative Metal Fences and Gates

32 33 00 - Site Furnishings

3.24 DIVISION 33 -- UTILITIES

3.25 DIVISION 34 -- TRANSPORTATION

3.26 DIVISION 40 -- PROCESS INTEGRATION

3.27 DIVISION 46 -- WATER AND WASTEWATER EQUIPMENT

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PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:

B. Geotechnical Report: Entitled RABA KISTNER Project No. AMA25-026-00, dated 01/2/2026.
   1. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   2. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 00 31 00

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PART 1 GENERAL

1.01 PROJECT

A. Project Name: Cibolo Animal Services

B. Architect's Name: Quorum Architects, Inc..

C. The Project consists of the construction of

Construction of a new 9,490-square-foot Animal Services Facility and associated site improvements. The project includes all labor, materials, equipment, and services necessary to deliver a complete and operational facility.

The building shall provide animal intake, housing, adoption, veterinary support, administration, storage, maintenance, and staff support functions. Animal housing shall be designed to accommodate 66 cats and 30 dogs with appropriate separation, sanitation, ventilation, and operational support areas.

Site improvements shall include construction of covered outdoor dog kennel areas, secure dog exercise and play yards, and perimeter fencing with controlled access gates. Exterior animal areas shall include appropriate drainage, lighting, and durable surface materials suitable for animal care operations.

Parking and site circulation improvements shall include 20 public parking spaces, with sufficient area reserved for the future expansion of 10 additional public parking spaces, and 21 dedicated staff parking spaces. Additional site work shall include driveways, sidewalks, accessible routes, landscaping, stormwater management, utility connections, site lighting, and signage.

The completed project shall provide a modern, durable, code-compliant Animal Services Facility designed to support efficient operations, animal welfare, public access, and future growth while meeting all applicable local, state, and federal requirements.

1.02 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.03 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

END OF SECTION 01 10 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Price and Contract Time.

1.02 RELATED REQUIREMENTS

A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

A. Deduct Alternate - No. 1 - Remove the South Drive, Dumpster Enclosure and Gate:
   1. Remove the South Drive Approach from East Schaefer Road, including concrete driveway extended to south vehicular gate, including roadway prep. Remove Dumpster Enclosure near East Schaefer Road. Remove South vehicular chainlink gate, including motorized controller, replace with chainlink fence to match adjacent panels.

B. Deduct Alternate No. 2A - Replace ceramic floor tile with LVT in the Vetibule, Lobby, and Public Corridors.
   1. Refer to Finish Schedule for LVT materials. Rubber Base to remain.

C. Deduct Alternate No. 2B - Replace Ceramic Tile with LVT in the Back of House and Office Areas
   1. Refer to Finish Schedule for LVT materials. Rubber Base to remain

D. Deduct Alternate No. 3 - Replace Ceramic Wall Tile in Work Rooms and Medical Room with FRP Wall Panels.
   1. Refer to Finish Schedule for FRP materials. Epoxy cove base to remain.

E. Deduct Alternate No.4 - Remove glazing/frame at Reception Counter

F. Deduct Alternate No. 5 - Provide Composition Shingle Roof, equal to Elk Prestique and cement fiber fascia and soffit.– in lieu of standing seam metal roof and metal fascia and soffit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 23 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms indicated and included in the Project Manual are adequate for this purpose, and must be used.
   2. Each substitution request shall include the name of the materrial or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cutsheets, performance and test data and any other materials, equipment or other Work that incoporation of the substitute would require shall be included.
   3. **The burdon of proof of the merit of the proposed substitute is upon the proposer.**

D. Limit each request to a single proposed substitution item.

E. The materials, products and equipment described in the Bidding Documents established a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
   1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

B. Submittal Form (before award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Architect will consider requests for substitutions only within 15 days after date of Agreement.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request and shall be final.

3.05 CLOSEOUT ACTIVITIES

A. Include completed Substitution Request Forms as part of the Project record.

3.06 ATTACHMENTS

A. Substitution Form is attached following spec section..

END OF SECTION

SUBSTITUTION REQUEST TO FOLLOW

PROJECT:

TO: QUORUM ARCHITECTS, INC.
825 WEST VICKERY BLVD., SUITE 100
FORT WORTH, TX 76104
DAVID DUMAN - DAVIDD@QARCH.COM 817.546.6315

REQUEST NO. _____
DATE: _____

CONTRACTOR:_____
SPECIFIED ITEM:

_____

SECTION: _____ PAGE: _____ PARAGRAPH: _____ DESCRIPTION: _____

DRAWING NUMBER(S): _____ DETAIL NUMBER(S):_____

THE UNDERSIGNED REQUEST CONSIDERATION OF THE FOLLOWING:

PROPOSED SUBSTITUTION

_____

_____

_____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:

_____

_____

SAVINGS OR CREDIT FOR ACCEPTING SUBSTITUTE: $_____

ATTACHED DATA INCLUDES DESCRIPTION, SPECIFICATIONS, DRAWINGS, PHOTOGRAPHS, PERFORMANCE, AND TEST DATA ADEQUATE FOR EVALUATION OF REQUEST; APPLICABLE PORTIONS OF DATA ARE CLEARLY IDENTIFIED.

ATTACHED DATA ALSO INCLUDES A DESCRIPTION OF CHANGES TO CONTRACT DOCUMENTS THAT PROPOSED SUBSTITUTION WILL REQUIRE FOR ITS PROPER INSTALLATION.

THE UNDERSIGNED CERTIFIES THAT THE FOLLOWING PARAGRAPHS, UNLESS MODIFIED BY ATTACHMENTS, ARE CORRECT:

1. **PROPOSED SUBSTITUTION HAS BEEN FULLY CHECKED AND COORDINATED WITH CONTRACT DOCUMENTS.**
2. **PROPOSED SUBSTITUTION DOES NOT AFFECT DIMENSIONS SHOWN ON DRAWINGS.**
3. **PROPOSED SUBSTITUTION DOES NOT REQUIRE REVISIONS TO MECHANICAL OR ELECTRICAL WORK.**
4. **THE UNDERSIGNED WILL PAY FOR CHANGES TO BUILDING DESIGN, INCLUDING ARCHITECTURAL AND ENGINEERING DESIGN, DETAILING, AND CONSTRUCTION COSTS CAUSED BY REQUESTED SUBSTITUTION.**
5. **PROPOSED SUBSTITUTION WILL HAVE NO ADVERSE AFFECT ON OTHER TRADES, CONSTRUCTION SCHEDULE, OR SPECIFIED WARRANTY REQUIREMENTS.**

6. MAINTENANCE AND SERVICE PARTS WILL BE LOCALLY AVAILABLE FOR PROPOSED SUBSTITUTION.

THE UNDERSIGNED FURTHER STATES THAT THE FUNCTION, APPEARANCE, AND QUALITY OF PROPOSED SUBSTITUTION ARE EQUIVALENT OR SUPERIOR TO SPECIFIED ITEM.

ATTACHMENTS: THE ATTACHED DATA IS FURNISHED HEREWITH FOR EVALUATION OF THE PROPOSED SUBSTITUTION.

[] CATALOG [] DRAWINGS [] SAMPLES [] REPORTS [] TESTS [] OTHER _____

SUBMITTED BY:

_____

(FIRM)

_____

(AUTHORIZED LEGAL SIGNATURE)

_____

(ADDRESS)

_____

(TELEPHONE)

FOR USE BY:

[] APPROVED [] APPROVED AS NOTED [] NOT APPROVED [] RECEIVED TOO LATE

DATE: _____ BY: _____

(AUTHORIZED LEGAL SIGNATURE)

REMARKS:

_____
_____
_____
_____
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_____
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_____

END OF SUBSTITUTION REQUEST FORM

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Administrative Provivisions
C. Watertight-Weathertight
D. Correlation and Intent of the Contract Documents
E. Time
F. Substantial Completion
G. Supplementary Contractor Rules and Guidelines
H. Safety
I. Security
J. Cleanliness
K. Environmental
L. Project Managment System
M. Preconstruction meeting.
N. Site mobilization meeting.
O. Progress meetings.
P. Construction progress schedule.
Q. Progress photographs.
R. Submittals for review and information.
S. Number of copies of submittals.
T. Requests for Interpretation (RFI) procedures.
U. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Information (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

1.03 ADMINISTRATIVE PROVISIONS

A. References to “Contractor” throughout the Documents are intended to include the Construction Manager, General Contractor and the applicable subcontractor.

B. Occupancy Prior to Completion: The Owner’s general intent is to accept the entire project; however, the Owner shall have the right to occupy a portion of the project considered substantially completed even though the Contractor may not have completed the entire project.

Such occupancy by the Owner will not release the Contractor or the bonding agency from any warranties or guarantees and final completion of work in accordance with the Contract Documents.

C. Contractor Use of Premises: The Contractor shall limit the storage of materials and equipment to the areas approved by the Owner. At no time during the work under the Contract shall the Contractor place or cause to be placed any material or equipment, etc. at any location that would impede or impair traffic or security. The Contractor shall fully cooperate with the Owner and Architect in providing traffic control during course of construction.

The Contractor shall send proper notices, make all necessary arrangements, and perform all services required in the care and maintenance of all public utilities. The Contractor shall, during the construction period and until final acceptance of the work by the Owner, assume all responsibility concerning the same for which the Owner may be liable.

D. Disposition of Utilities: Observe rules and regulations governing the respective utilities in executing all work under this heading. Adequately protect active utilities from damage and remove or relocate only as indicated or specified. Remove, plug or cap inactive and abandoned utilities encountered during the work. If there are no specific requirements, plug or cap such utility lines at least 3 feet outside of new building walls or as required by local regulations.

E. Reference Standards: For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes. The Date of the Standard is in effect as of the date of the Contract Documents, except when a specific date is specified.

F. Contractor shall submit weekly reports identifying work completed the previous week and work expected to be completed the next three weeks. AT the end of each month, Contractor shall issue a monthly summary documenting progress, changes, RFIs, ASIs, Change Orders, etc issued that month and any outstanding issues or concerns as well as a contingency log.

1.04 SIGNED DRAWINGS AND SPECIFICATIONS

A. Not Used

1.05 WATERTIGHT-WEATHERTIGHT

A. Anything in the Contract Documents not withstanding, the Contractor accepts the responsibility of constructing a watertight and weathertight project.

1.06 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

A. Before performing any portion of the Work, the Contractor shall investigate the physical aspects of the Project Site and verify all dimensions and elevations, existing improvements, surface and subsurface soil conditions, drainage of both surface and subsurface, soil plasticity, and general suitability of conditions at the Project Site.

B. In the event of conflicts, explanatory notes in the Drawings take precedence over graphic indications, large scale drawings and details take precedence over smaller scale drawings and figured, or calculated dimensions take precedence over scaled dimensions. The Contractor shall verify all dimensions by measurements of conditions and of Work in place.

C. The inter-relation of the Project Manual, the Drawings and the schedules are as follows: The Project Manual determines the quality, nature and setting of the materials; the Drawings establish the quantities, dimensions, and details; and the schedules give the location.

D. Should the drawings disagree in themselves, or with the Project Manual or with one another, or if proprietary information disagrees with performance requirements in either the Drawings or the Project Manual, the better quality or greater quantity of the Work or materials shall be estimated upon, and unless otherwise ordered by the Architect in writing, shall be performed or furnished. Should discrepancies or doubt occur, do not proceed with the Work without clarification from the Architect. Contractor shall request clarification in sufficient time to avoid delays and increases in the contract sum.

1.07 TIME

A. Contractor shall not request additional time to complete the project because of delay occurring on Saturdays, Sundays, or holidays.

B. The Time estimated by the Contractor for completion of the entire work ready for use shall include the number of calendar days, for anticipated delays due to normal weather conditions.

C. No time extension for delays due to weather will be allowed until and unless such delays exceed the time included for normal weather delays on a contractual basis. In case of claims for extension of time because of abnormal inclement weather, such extension of time shall be granted only when the contractor proves in a manner acceptable to the Architect, that such abnormal inclement weather prevented the execution of major items of work on normal working days for that month and affected the critical path for completion. A weather table reflecting the meteorological data from the local area is provided herein and will be used to determine contract time extensions due to abnormally inclement weather.

D. To this contract, “abnormal inclement weather” will be interpreted as the number of days more than the normal on which rainfall exceeds 0.01 inch or snow/ice pellets exceed 1.0 inch. Extension of time to complete the project will be based on actual working days. No extension of time will be allowed for extreme temperatures unless the installation of a material is specified to be installed within tolerance. Extensions will then only be granted if conditions identified in 1.08 are followed. All requests for extensions must be submitted monthly for the previous month's work and accompany the scheduled Pay Application. **Any days not requested in this manner will not be considered.**

WEATHER TABLE

MONTH	AVERAGE DAYS RAIN (1)	INCHES RAINFALL (2)	SNOW/ICE PELLETS (3)
JANUARY	7	1.80	1
FEBRUARY	7	2.36	*
MARCH	7	2.54	*
APRIL	8	4.30	0
MAY	8	4.47	0
JUNE	6	3.05	0
JULY	5	1.84	0
AUGUST	5	2.26	0
SEPTEMBER	7	3.15	0
OCTOBER	5	2.68	0
NOVEMBER	6	2.03	*
DECEMBER	6	1.82	*
ANNUAL TOTALS:	**77**	**32.30**	**1**

(1) Mean number of days rainfall, 0..01" or more

(2) Average normal precipitation, in"

(3) Mean number of days 1.0" or more

* Less than one-half"

1.08 SUBSTANTIAL COMPLETION

A. The Work will not be considered suitable for Substantial Completion review until all project systems included in the work are complete, tested, and operational as designed and scheduled, all designated or required governmental inspections and certifications including certificate of occupancy, have been made and posted, designated instruction of Owner's personnel in the operation of systems has been completed, and all final finishes within the Contract documents are in place. In general, the only remaining work shall be minor in nature,

so that the Owner could occupy the building on that date and the completion of the Work by the Contractor would not interfere or hamper the Owner's normal business operations. As a further condition of Substantial completion acceptance, the Contractor shall certify that all remaining Work, the same being solely of a "punchlist" nature, will be completed within thirty (30) consecutive calendar days following the Date of Substantial completion.

B. Notwithstanding the foregoing, the Owner may refuse to make payment on any Certificate of Substantial completion or any Certificate of Payment (including, without limitation, the final Certificate of Payment) for any default of the Contractor. The Owner shall not be deemed in default by reason of withholding payment while any of such defaults remain uncured. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such certificate. Upon such acceptance and consent of surety, the Owner shall make such payment as to bring the total payment for the work completed to 95% of the contract amount. Such payment shall be adjusted for work that is incomplete or not in accordance with the requirements of the contract documents. No reduction in retainage will be considered until all remaining items, no matter the size or complexity, are complete and Final Completion is achieved.

1.09 SUPPLEMENTARY CONTRACTOR RULES AND GUIDELINES

A. The Owner requires that all Contractors' personnel while on the Owner's premises comply with all Federal, State and Local ordinances and Standards. To assist in complying with these and other applicable requirements, the following Contractor Rules and Guidelines must be followed in addition to the requirements in Division 1. Violations of the following rules are considered major infractions and violation of these rules will subject Contractor's employees to immediate ejection from owner's property:
   1. Possession of firearms on Owner's property.
   2. Possession of or under the influence of alcoholic beverages or illegal drugs on Owner's property.
   3. Unwarranted and/or objectionable comments or gestures to the Owner's or other personnel.
   4. Physical assault on another individual.
   5. Welding or using acetylene torches without proper safety measures.
   6. Gross misconduct (includes language, harassment, etc.)
   7. Willful destruction of the Owner's property.
   8. Conviction of criminal action.
   9. Theft of property.
   10. Possession of pornographic or other objectionable materials.
   11. Smoking in enclosed buildings, whether construction is complete.

1.10 SAFETY

A. Contractor shall enforce the most recent requirements of Occupational Safety and Health Act, at the Contractor's expense.

B. Contractor shall erect barricades, safety signs and warning lights around excavations, temporary structures, and construction equipment, where such obstructions present a hazard to pedestrians and automobile traffic.

C. When the use or storage of explosive or hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel and shall coordinate all such activity with the Owner.

D. Contractor must assure that all moves are made in such a manner that floor loads for buildings are not exceeded.

E. Contractor shall, at the Owner's request, provide safety records, including worker's Compensation insurance experience modification rate and the OSHA total recordable injury rate.

F. All equipment must meet applicable standards and be in good repair (i.e., ladders, power equipment, hand tools, etc.). All guards and protective devices must be in place and operating.

G. Cable trays, ductwork and/or piping systems shall not be used for climbing, walking, or sitting nor support of other facilities or equipment.

H. Violation of safe practices that are not corrected after ample notification will be grounds for termination of the Contract.

I. Contractor shall maintain a temporary construction fence around entire area of construction to prevent unauthorized access for the purpose of safety and security throughout the duration of construction. Contractor shall provide knox locks on fence as required by Fire Department.

1.11 SECURITY

A. Contractor will arrange work in such a manner as to cause minimal interruption to traffic and pedestrian flow.

B. If it is necessary to close streets, driveways, or walkways, a closure plan must be submitted in advance including times and re-routing plans for approval.

C. Contractor will provide such barricades and other closures as designated by the Owner. If left in place during darkness, provide, operate, and maintain lights for the duration of the closure.

D. Where job site requirements necessitate removal or breaching of security barriers such as construction or security fences, prior approval is required by Owner. The Contractor will then comply with the directions to maintain controlled access to secure areas. In no case will openings remain overnight or unattended in a breached condition.

1.12 CLEANLINES

A. The Contractor shall maintain the cleanliness of all areas affected by construction on this project.

B. Contractor shall clean up and clear obstructions in the work area. Cleanup will include the safe storage of flammable liquids such as paint and paint thinners.

1.13 ENVIRONMENTAL

A. All Work must be performed in accordance with all Federal, State and Local regulations pertaining to the protection of the environment.

B. Contractor and Subcontractors shall take all precautions necessary to prevent damage to the environment during the Work.

C. Contractor shall be held strictly responsible, both legally and financially, for all damage to the environment caused by the Contractor or his Subcontractors during the execution of this Contract.

D. Disposal of all chemical substances by the Contractor, including oils and chemical containers, will be per local, State, and Federal requirements.

E. In no case shall a Contractor dispose of any chemical substance or hazardous waste by pouring it on the ground, down a drain, in a sewer or storm sewer, or in a trash dumpster.

F. Contractor shall recycle all construction waste on this project to divert as much waste as possible from the Landfill.

G. All spills of chemical substances of hazardous or non-hazardous wastes shall be reported immediately by the contractor to the Owner.

H. Contractor shall recycle as much construction waste as reasonable on this project to divert as much waste as possible from the Landfill.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT MANGAGMENT SOFTWARE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   5. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   6. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Architect's Project Managment Selected Service:
   1. Newforma Project Center (NPC) with Newforma Info Exhange (NIX): www.newforma.com.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

3.02 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Architect will schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.

2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals or as agreed upon by all parties.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 15 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Identify each item by specification number

E. Show accumulated percentage of completion of each item, and total percentage of work completed, as of the first day of each month.

F. Coordinate content with schedule of values.

G. Submit updated schedule with each Application for Payment.

3.06 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of work produced by a commercial photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:

E. Views:
1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
3. Consult with Architect for instructions on views required.
4. Provide factual presentation.
5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.07 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
   a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
   b. Do not forward requests which solely require internal coordination between subcontractors.

2. Prepare using software provided by the Electronic Document Submittal Service.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
a. Approval of submittals (use procedures specified elsewhere in this section).
2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Discrete and consecutive RFI number, and descriptive subject/title.
3. Issue date, and requested reply date.
4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.

H. Review Time: Architect will respond and return RFIs to Contractor within ten calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.08 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.

4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), and description of item of work covered.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.09 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.10 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

A. General Requirements:
1. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
4. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
    b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 14 days.
5. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
6. Provide space for Contractor and Architect review stamps.
7. When revised for resubmission, identify all changes made since previous submission.
8. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
   3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.
   4. Submit full range of manufacturers' standard colors, textures, and patterns for Architect's selection. Submit samples for selection of finishes within 45 days after date of Notice to Proceed.

E. Quorum Architects will make available, upon request, CAD file documents for use by contractors and/or sub-contractor as background for shop drawing and/or record set documentation only, as referenced herin. Exhange of subject information in no way relieves any party of responsabilities as defined under the Terms of Agreement. For CAD file documents from other disciplines and Architect's consultants, contractor shall contact Architect with request. Contractor may be required to fill CAD request forms for Architect and individual consultants.

3.12 SUBMITTAL REVIEW

A. Architect and Consultants' will act on a maximum of two submittals for each drawing, product data or sample of the same item. In the event of a third submittal is required, Contractor shall bear cost of processing by the Architect/Consultant. Cost shall be determined based on the agreed fees for additional services of the contract between the Architect and Owner.

B. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

C. Submittals for Information: Architect will acknowledge receipt, but will take no other action.

D. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

E. Architect's and consultants' actions on items submitted for review:
   1. Approval of the Contractor's submittal does not constitute a complete check but indicates only that design, general method of detailing is satisfactory. Approval does not permit any deviation from the Contract requirements and does not relieve the Contractor of the responsibility for errors in dimensions, details, sizes of members, etc., or the coordinating installation and construction with actual conditions of the Work.
   2. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted", or language with same legal meaning.
      c. "Partial Resubmittal", or language with same legal meaning.
         1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
   3. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
      b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

F. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 01 30 00

PART 1 GENERAL

1.01 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

1.02 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide legend for symbols and abbreviations used.

END OF SECTION 01 32 16

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance.

B. Workmanship

C. Manufacturers' Instructions

D. Manufacturers' Certificates

E. References and standards.

F. Testing and inspection agencies and services.

G. Contractor's design-related professional design services.

H. Control of installation.

I. Mock-ups.

J. Tolerances.

K. Manufacturers' field services.

L. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 42 16 - Definitions.

C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

1.04 QUALITY ASSURANCE

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality

1.05 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

D. Monitor fabrication and installation tolerances control of products to produce acceptable work.

1.06 MANUFACTURERS' INSTRUCTIONS

A. Comply with instructions in full detail, including every step, in sequence. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

B. Comply with Manufacturer's tolerances. Should conflicts with Contract Documents occur, request clarification from Architect before proceeding.

1.07 MANUFACTURERS' CERTIFICATES

A. When required by individual Specifications Section, submit manufacturer's certificate, in duplicate that products meet or exceed specified requirements.

1.08 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

D. Notify Architect and Owner fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

I. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

K. Where possible salvage and recycle the demolished mock-up materials.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Architect.
2. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION 01 40 00

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

1.03 REFERENCE STANDARDS

A. Various sections of specifications contain references to specific standards. Applicable portions of standards listed that are not in conflict with specification requirements are hereby made a part of the Contract Documents.

B. For products or workmanship specified by association, trade, or other consensus standard, except when more rigid requirements are specified or are required by applicable codes.

C. Modifications and exceptions to standards shall be considered as amendments and unmodified portions shall remain in effect.

D. In case of conflict between standards, or between specifications and standards, most stringent requirement shall govern.

E. Editions of standards shall be the latest edition at the time of contract award, including any supplements or amendments thereto.

F. Maintain copies of standards at the project site during submittals, planning, and progress of the specific work, until substantial completion.

G. Neither the contractual relationship, duties, and responsibilities of the parties in the contract nor those of the Architect shall be altered by the contract documents by mention or inference otherwise in any reference documents.

1.04 SCHEDULE OF ABBREVIATIONS

A. Reference standards are listed in various sections using abbreviations contained below.

B. The following schedule is partial; additional abbreviations and standards may appear in various sections and all abbreviations and standards may not appear.

C. GENERAL SPECIFICATION ABBREVIATIONS

Cubic Foot	cu. ft.	Ounce	oz.
Degree	deg.	Outside Diameter	o.d.
Diameter	dia.	Pound	lb
Feet or Foot	ft.	Pounds per cubic Foot	pcf
Inch	in.	Pounds per Square Foot	psf
Inside Diameter	i.d.	Pounds per Square Inch	psi
Miles Per Hour	mph	Square Foot	sq. ft.
Millimeter	mm	Square Inch	sq in.

&	and	BD.	board
L	angle	BITUM.	bituminous
@	at	B.L.	building line
C	centerline	BET.	between
	diameter or round	BLDG.	building
#	pound or number	BLK.	block
A.B.	anchor bolt	BLKG.	blocking
ACC.	access	BM.	beam
ACOUS.	acoustical	BOT.	bottom
ACT.	acoustical tile	BRG.	bearing
A/C	air conditioning	BSMT.	basement
A.D.	area draini	BUR	built-up roofing
ADA	American Disability Act Accessibility Guidelines	CAB.	cabinet
ADJ.	adjacent	C.B.	catch basin
ADJT.	adjustable	CEM.	cement
A.F.F.	above finish floor	C.I.F.	cut in field
AGGR.	aggregate	CPT.	carpet(ed)
AHU	air handling unit	CER.	ceramic
AL.	aluminum	C.I.	cast iron
ALT	alternate		
A.P.	Access Panel	C.G.	corner guard
APPROX.	approximate	C.J.	control joint
ANOD.	anodized	CLG.	ceiling
ARCH.	architectural or architect	CLG. HT.	ceiling height
ASPH.	asphalt	CLKG	caulking
AUTO.	automatic	CLO.	closet
C.O.	cased opening	CLR.	clear(ance)
COL.	column	F.A.	fire alarm
CMU	concrete masonry units	F.A.I.	fresh air intake
COMP.	compressible	F.B.	flat bar
CONC.	concrete	F.D.	floor drain
CONN.	connection	FDN.	foundation
CONST. JT.	construction joint	F.E.	fire extinguisher
CONSTR.	construction	F.E.C.	fire extinguisher cabinet
CONT.	continuous	F.H.C.	fire hose cabinet
CORR.	corridor	F.H.S	fire hose station
CTSK.	countersunk	FIN.	finish
CNTR.	counter	FL.	floor(ing)
CTR.	center	FLASH.	flashing
C.W.	curtain wall or cold water	FLUOR.	fluorescent
D.	deep or depth	F.O.C.	face of concrete
DBL.	double	F.O.F.	face of finish

DEPT.	department	F.O.S.	face of studs
D.F.	drinking fountain	FP	fire proofing
DET.	detail	FPRF.	fire proof
DIA.	diameter	F.P.S.C.	fire proof self closing
DIAG.	diagonal	F.R.	fire resistant
DIF.	diffuser	F.S.	full size
DIM.	dimension	FT.	foot or feet
DISP.	dispenser	FTG.	footing
DN.	down	FURR.	furring
D.O.	door opening	FUT.	future
DR.	door	G.	granite
DWR.	drawer	GA.	gauge
DS.	downspout	GALV.	galvanized
D.S.P.	dry standpipe	G.B.	grab bar
		GL.	glass, glazing
DWGS.	drawings	GL.BLOCK	glass block
DTL.	detail	GND.	ground
E.	east	GR.	grade, grading
EA.	each	G.W.B.	gypsum
E.I.F.S.	exterior insulation finish system	H.	high
E.J.	expansion joint	H.B.	hose bibb
EL.	elevation	HBD.	hardboard
ELEC.	electrical	H.C.	handicapped
ELEV.	elevator	HDR.	header
EMER.	emergency	HDWD.	hardwood
ENCL.	enclosure	HDWE.	hardware
E.P.	electrical panelboard	HGT.	height
EQ.	equal	H.M.	hollow metal
EQPT.	equipment	H.O.	high output
E.W.	each way	HORIZ.	horizontal
E.W.C.	electric water cooler	H.P.	high point
EXH.	exhaust	HR.	hour
EXIST.	existing	HTG.	heating
EXPO.	exposed	H.W.	hot water
EXP.	expansion	H.V.A.C.	heating/ventilation/air conditioning
EXT.	exterior	HYD.	hydrant
I.D.	inside diameter (dim.)	O.A.	overall
IN(")	inch	OBS.	obscure
INCL.	include (d), (ing)	O.C.	on center
INSUL.	insulation	O.D.	outside diameter (dim.)
INT.	interior	OFF.	office
		OPNG.	opening
JAN.	janitor	OPP.	opposite
JT.	joint	P.	person

KI.	kitchen	P.B.D.	particle board
K.O.	knock out	PERF.	perforate (d)
LAB.	laboratory	PL.	plate
		P.L.	property line
LAM.	laminate (d)	PLAM.	plastic laminate
LAD.	ladder	PLAS.	plaster
LAV.	lavatory	PLGL.	plate glass
L.H.	left hand	PLBM.	plumbing
L.	length	PLYWD.	plywood
LT.	light	PNL.	panel
LT. WT.	light weight	PRCST.	precast
LIN.	linear	P.S.F.	pounds per square foot
LKR.	locker	P.S.I.	pounds per square inch
LVR.	louver	P.T.	pressure treated
L.P.	low point	PT.	point
MAX.	maximum	PTD.	paint(ed)
M.C.	medicine cabinet	P.T.D.	paper towel dispenser
MAS.	masonry	P.T.D/R	combination paper towel dispense and receptacle
MATL.	material	PTN.	partition
MED.	medium	P.T.R.	polyvinyl chloride
M.E.P.	mechanical/electrical/plumbing	Q.T.	quarry tile
MECH.	mechanical	R.	riser
MEMB.	membrane	R.A.	return air
MET.	metal	RAD.	radius
MEZZ.	mezzanine	R.D.	roof drain
MLD.	molding, moulding	RE.	reference
MFR.	manufacturer	RECP.	receptacle
MH.	manhole	REF.	reference
MIN.	minimum	REFR.	refrigerator
MIR.	mirror	REINF.	reinforcing or reinforced
MISC.	miscellaneous	REQ'D.	required
M.O.	masonry opening	RET.	return
MOV.	movable	REV.	revision (s, ed)
MPH	miles per hour	RGTR.	register
M.R.	mop receptor	R.H.	right hand
MTD.	mounted	RESIL.	resilient
MUL.	mullion	RM.	room
N.	north	R.O.	rough opening
NAT.	natural	RWD.	redwood
N.I.C.	not in contract	R.W.L.	rainwater leader
NO. OR#	number	UNF.	unfinished
NOM.	nominal	U.N.O.	unless noted otherwise

N.T.S	not to scale	UR	urinal
S.	south	V.	vinyl
S.C.	solid core	VAR.	varnish
SCHED.	schedule	V.B.	vapor barrier (retarder)
S.D.	storm drain	V.C.T.	vinyl composite tile
SECT.	section	VERT.	vertical
S.F.	square feet	VEST.	vestibule
SHR.	shower	V.I.F.	verify in field
SHT.	sheet	VNR.	veneer
SIM.	similar	W.	west
S.N.D.	sanitary napkin dispenser	W/	width
S.N.R.	sanitary napkin receptacle	W.C.	water closet
SPEC.	specification	WD.	wood
SPK.	speaker	WDW.	window
SQ.	square	W. GL.	wired glass
S.S.	stainless steel	W.M.	wire mesh
STA.	station	W/O	without
STD.	standard	WP.	waterproof
STL.	steel	W.P.	worring point
STOR.	storage	WS.	watehre stripping
STRUCT.	structural	WSCT.	wainscot
SUSP.	suspended	WT.	wight
S.Y.	square yard	W.T.W.	wall to wall
SYS.	system	W.W.F.	welded wire fabric
SYM.	symmetrical		
T.	tread		
TAS.	texas accessibility standards		
T.B.	towel bar		
T.C.	top of curb		
TEL.	telephone		
TEMP.	tempered		
TER.	terrazzo		
T&G	tongue and groose		
THK.	thick		
THRES.	threshold		
T.O.B.	top of brick		
T.O.C.	top of curb		
TOL.	tolerance		
T.O.P.	top of panel		
T.O.S.	top of steel (slab)		
T.O.W.	top of wall		
T.P.	top of pavement		
T.P.D.	toilet paper dispenser		

T.S.	tube steel		
TV.	television		
TX.	transformer		
TYP.	typical		

(NOTE: THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REPORTING ANY ABBREVIATIONS ON THE DRAWINGS THAT ARE NOT LISTED AND NOT UNDERSTOOD, TO THE ARCHITECT FOR CLARIFICATION AT LEAST 7 DAYS PRIOR TO BID OPENINGS. ADDITIONAL COSTS WILL NOT BE ALLOWED FOR CLARIFICATION OF ABBREVIATIONS AFTER BID OPENING AS IT WILL BE ASSUMED THAT THE CONTRACTOR UNDERSTOOD THE ABBREVIATION AT THE TIME THE BID WAS SUBMITTED.)

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 42 16

END OF SECTION 01 42 19

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Requirements.

B. Work Included.

C. Submittals.

D. Quality Control.

E. Laboratory Responsibilities.

F. Specific Tests, Inspections and Methods Required.

1.02 GENERAL REQUIREMENTS

A. An Independent Testing Agency selected by the Owner will perform the inspection and laboratory services for all testing specified herein.

B. The Owner will execute a contract with their selected agency based on requirements in this Section of Specifications. The Owner will pay the agency directly for services performed.

C. In the event certain materials or installation of materials in construction do not measure up to required standards or specifications, the defective materials or work shall be removed and replaced at Contractor's expense including all subsequent testing of materials in question.

D. Testing Agencies shall perform required inspections and tests in accord with Building Code, Local Authorities, State Regulations and the specifications of ASTM and other respective technical societies.

E. The purpose of the testing by the Owner's selected Testing Laboratory is to verify conformance of materials and construction with the projects Contract Documents and do not relieve the Contractor from the responsibility of providing his own quality control of inspection and testing.

1.03 WORK INCLUDED

A. Inspecting and testing soil work in connection with building excavation and fill including subgrades below pavement and slabs and compacted fill and backfill.

B. Inspection to establish bearing strata of foundation piers.

C. Inspection and testing of materials and installation of materials of cast-in-place reinforced concrete, as specified.

D. Inspection of structural steel installation.

E. Inspection and testing of structural steel and metal building components.

F. Inspection and observation of roofing material application and water stops.

G. Other specific tests and inspections are required for specific individuals or sections of the Documents.

1.04 SUBMITTALS (CERTIFICATION)

A. Submit two copies to the Architect and one copy to the Contractor of certification of each inspection and test required.

B. In each certificate state details of each inspection and test to indicate satisfactory compliance with requirements of Drawings and Specifications or unsatisfactory condition or failure to comply with requirements.

C. Include:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.

6. Location in the Project
7. Location of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.
11. When requested by Architect / Engineer, provide interpretation of test results.

1.05 QUALITY CONTROL (ACI 301 1.6)

A. Laboratory will meet requirements of ASTM C1077 .

B. Laboratory will have been inspected by an independent agency such as Cement and Concrete Reference Laboratory CCRL or AASHTO Material Reference Laboratory AMRL.

C. Laboratory will meet “Recommended Requirements for Independent Laboratory Qualification,” published by American Council of Independent Laboratories.

D. Laboratory will be authorized to operate in state in which Project is located.

E. An ACI Certified Concrete Laboratory Testing Technician – Grade II will be responsible for concrete testing services.

F. An ACI Certified Concrete Construction Inspector will be responsible for concrete inspection services.

G. An ACI Certified Concrete Field-Testing Technician – Grade I will be responsible for field testing services.

H. Technicians performing field tests will have available to them a copy of ACI SP-15. Field Reference Manual: Specifications for Structural Concrete for Building with Selected ACI and ASTM References.

I. Weld Inspectors will be AWS Certified Welding Inspector per AWS QCI. Inspectors performing nondestructive testing of welds other than visual will be NDT Level II Per American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A.

J. Laboratory will provide one plant inspection of ready-mixed concrete plant at the beginning of post-tension concrete placement (precast topping placement). Additional visits will be as directed by Engineer. Observations will be in accordance with ACI 311.5R-02 1.3.2.

K. Employment of Laboratory will in no way relieve Contractor’s obligations to perform Work of Contract.

1.06 LABORATORY RESPONSIBILITIES

A. Generally shall follow ACI 301 1.6.4 with additional requirements.

B. Laboratory will cooperate with Engineer, Contractor, and Subcontractors to provide qualified personnel upon due notice.

C. All testing will be performed in a timely manner to prevent installation (or to allow for removal) of non-conforming material.

D. All tests will be reported in writing to Contractor, Subcontractor, Supplier, Installer, etc., Engineer, and Owner. Written reports of test results will be delivered to above parties within 48 hours of testing or by E-mail if immediately requested. Each report will include, as a minimum, following:
   1. Report number.
   2. Date Issued.
   3. Project title and number.
   4. Name of Contractor and subcontractor if applicable.
   5. Supplier.
   6. Testing Laboratory name, address, and telephone number
   7. Name and signature of Laboratory Field Technician.
   8. Date and time of sampling or inspection.

9. Record of temperature and weather conditions.
10. Date of test.
11. Identification of product and Specification Section.
12. Location of sample or test in Project
13. Type of inspection or test.
14. Results of tests and compliance with Contract Documents.
15. Interpretation of test results when requested by Engineer.

1.07 SPECIFIC TESTS, INSPECTIONS AND METHODS REQUIRED

A. Excavating, Backfilling and Compaction.
   1. Determine suitability of all materials to be used as fills, backfills, and leveling beds.
   2. Perform one optimum moisture-maximum density curve in accordance with ASTM D1557 for each type of soil proposed for use.
   3. One field density test for each 2500 square feet or fraction thereof of each in-place fill layer in accordance with either ASTM D 1556, D 2167, or D 2922.
   4. Provide daily inspection and reports for compaction work.
   5. Confirm adequacy of bearing conditions for the following:
      a. Drilled Concrete Piers
      b. Slab-on-Grade
      c. Footings
   6. Establish moisture-density relationship, ASTM D698, for each soil type.
   7. Perform field in-place density tests, ASTM D2922 or D1556, as follows; min. three tests for each lift or area:
      a. Building Subgrade: One test for each 2,500 sq. ft. or fraction thereof, per lift.
      b. Paving Subgrade: One test for each 5,000 sq. ft. or fraction thereof, per lift.
      c. Trench Backfill:
         1) Establish level of compaction effort by frequent testing on initial lifts.
         2) Make random tests of subsequent lifts of backfill. Frequency of random tests shall be adequate to guarantee proper compaction and in no case shall be less than a rate of one test per lift per 200 lineal feet of trench backfilling.
   8. Inspection and Testing of Lime Stabilized Subgrade: Continuous inspection of lime stabilization procedures to determine type and amount of lime used, and depth of treatment. One field in-place density test, ASTM D2922, for each 4,000 sq. ft. or fraction thereof of stabilized subbase.
   9. Drilled Piers and Footings:
      a. Inspect foundation pier drilling at the beginning of the drilling to identify the bearing strata and certify as to adequacy of material that supports piers by end bearing and skin friction.
      b. Inspect excavations for footings to identify the bearing strata and certify as to adequacy of material that supports the footing.
      c. Prepare log of pier depths.

B. Asphalt Paving:
   1. Asphalt Pavement Density
      Sample per ASTM D 979.
      Comparative density test per ASTM D 2950.
      (Base line density to be Marshall density – ASTM D 1559)
      Frequency: One test per 50 square yards, per mix, with minimum of one sample per day, per mix.
   2. Asphalt Pavement Stability, Flow, VMA, etc.
      Sample per ASTM D 979
      Marshall test per ASTM D 1559.
      Frequency: 1 sample per day, per mix.
   3. Asphalt Pavement Bituma Content

Sample per ASTM D 979.
ASTM D 4125.
Frequency: 1 sample per day, per mix.
Refer to State Highway Specifications for sampling and testing requirements.

C. Cast-In-Place Concrete (ACI 301 1.6.4 and ACI 311.5R-1.3, 2.4): Comply also with testing requirements established in governing building codes. Additional requirements are specified as follows:
   1. Concrete Compression ASTM C 39
      a. Laboratory will have a compression machine capable of breaking 6” x 12” cylinders 10,000 psi or be prepared to test 4” x 8” cylinders in accordance with ASTM standards.
      b. Take a minimum of six cylinders for each 50 cubic yards, or fraction thereof, of each mix design of concrete placed in any one day (eight cylinders for post-tensioned concrete).
      c. Compression test sample size will be 6” x 12” cylinders except that 4” x 8” cylinders may be used for silica fume concrete.
      d. Compression tests 1) Test two cylinders at two or three days for post-tensioned concrete only. 2) Test two cylinders at seven days. 3) Test two cylinders at 28 days. 4) Hold 2 cylinders in reserve for use as the Engineer directs.
      e. After 56 days, unless notified by the Engineer to the contrary, reserve cylinders may be discarded without being tested for specimens meeting 28-day strength requirements.
   2. Slump Test
      a. Conduct one slump test per batch at the point of placement ASTM C 143.
         1) When water reducing admixtures or high range water reducing admixtures are added at job site, test concrete slump prior to addition of admixtures.
   3. Ambient Air Temperature and Composite Concrete Sample Temperature.
      a. Record temperatures for each batch of concrete ASTM C 1064.
   4. Unit Weight
      a. Conduct unit weight test ASTM C138.
   5. Water Content Testing
      a. Water content of freshly mixed concrete will be tested on a random basis during placement in accordance with AASHTO TP 23, Proposed Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying. Test shall be run each time test cylinders are molded or whenever directed by Engineer.
   6. Submit for record field test reports including following information ACI 311.5R1
      a. Project information as specified herein
      b. Design mix number
      c. Design strength
      d. Cement content
      e. Water content
      f. Coarse aggregate lbs/yd
      g. Fine aggregate lbs./yd
      h. Admixtures
      i. Truck number and/or ticket number
      j. Drum rotation revolution
      k. Cubic yards
      l. W/C ratio
      m. Batch time
      n. Discharge start time
      o. Empty time
      p. Sample time
      q. Slump

r. Air Content
s. Air temperature and concrete temperature
t. Location of placement and location of sample batch

7. Submit for record laboratory test results including following information in addition to information cited under field tests.
   Cylinder identification
   Date tested, concrete age
   Total load
   Compressive strength
   Type of fracture
   Method of curing
   Weight of cylinder
8. Submit for record concurrent graphs of laboratory test results including following information:
   Cylinder identification
   Concrete strength
   Air content
   Other information agreed upon.
9. Test concrete drying shrinkage for each 50 cubic yards or fraction thereof, of each mix design of concrete placed in any one day in accordance with ASTM C 157. Maximum concrete shrinkage for specimens cast in field shall not exceed trial batch maximum shrinkage requirement by more than 25 percent.

D. Concrete Reinforcement
   1. Prior to placing concrete verify the following:
      a. Reinforcement is shipped, handled, and stored as specified.
      b. Conventional steel is correctly placed, including proper number, location, cover, supports, and splices.
   2. During concrete placement verify following:
      a. Forms are clean, free of cut bars, tie wire, saw dust, debris, etc. before concrete placement.
      b. Inserts, sleeves, and blockouts for mechanical, electrical, and precast concrete work are installed at proper location and sizes.
      c. Expansion joint blockouts at proper location and size.
      d. Concrete placement does not displace position of reinforcement or tendons and pump lines are independently supported.
      e. Concrete placement does not displace position of reinforcement or tendons and pump lines are independently supported.
      f. Concrete is properly consolidated, especially in areas of reinforcement congestion and tendon anchorage to eliminate voids and honeycombing. Verify vibrators are not laid on tendons and reinforcement.
      g. Water is not added to concrete trucks at job site without prior approval of Engineer.
      h. Spraying of water directly on slab surface does not occur during fogging operations.
      i. Concrete placement and finishing procedures comply with Contract Documents and as agreed during pre-pour meeting.
      j. Cold weather and hot weather concreting practices are followed as specified.
      k. Finishing and jointing procedures are followed as specified.
      l. Wet cure practices are followed as specified.
      m. Flood tests of concrete slabs and areas of inadequate drainage to be repaired by Contractor.

E. Fabricated Hardware for Cast-In-Place or Precast Concrete
   1. At start up of fabrication, review and verify welding procedures.
   2. At mid schedule of production, randomly select and inspect 25 percent of pieces fabricated. Visually inspect welds, provide magnetic particle examination if required. If

greater than or equal to two percent of welds are unacceptable, increase random sampling frequencies to 50 percent. If greater than or equal to five percent are unacceptable, inspect all pieces.

3. Last visit prior to shipping and installation review uninspected pieces per guidelines of mid schedule visit.
4. Report will include:
   Date of inspection
   Description of pieces or procedure reviewed.
   Status (approval, rejection)
   Remedial work required, date carried out, date of final passing inspection.
   Any comment or observations regarding condition

F. Masonry Inspection
1. Sample and test mortar before and during construction (for each 5000 sq. ft. of masonry) in accordance with ASTM C 780.
2. Sample and test grout before and during construction (for each 5000 sq. ft. of grouted masonry) in accordance with ASTM C 1019.
3. Provide continuous inspection of masonry Work including following:
   Mortar preparation and handling
   Protection of masonry materials
   Cold weather procedures
   Conformity of masonry construction with Specifications
4. Provide continuous inspection of grouted masonry Work including following:
   Alignment of cores, absence of foreign material and grout droppings.
   Reinforcement position and spacing
   Vibration of grout
   Conformity of grouting operations with the specifications

G. Structural Steel
1. All welds will be visually inspected. Twenty-five (25) percent at random will be measured.
2. Test 15 percent of all fillet welds at random by magnetic particle for final pass only.
3. Ultrasonically test 100 percent of all full-penetration welds.
4. 4. Ultrasonically test 100 percent of partial penetration column splice welds.
5. 5. Ultrasonically test for lamination in column flanges for rigid frame beam to column moment connections. Such zones extend nine (9) inches on either side of the top beam flange for full width of the column flange. Fabricator will mark out areas on column flanges where field weld for top beam flange connection will be made. Test column flange only at top beam flange location.
6. 6. Inspect 10 percent of welded shear connectors by bending them 15 degrees in accordance with AWS D1.1. If base welds is not full circumference of stud, bend stud back 30 degrees away from missing portion of weld.
7. 7. Monitor installation of bolts to determine that in bearing type connections, all piles of connected material have been drawn together and that selected procedures is properly used to tighten all bolts.
8. 8. Slip critical bolts will be assured that specified procedure are followed to achieve pre-tensioned specified in Table 4, RCSC Specification for Structural Joints.

H. Waterproofing – Concrete Sealers
1. Obtain concrete sealer samples at point of application to concrete. Each sample will consist of approximately two pints of material. Sampling will be random, but as a minimum, will be taken as follows:
   One sample for each 55-gallon drum.
   One sample for every 5,000 square feet of slab surface sealed.
   Timing of sampling will be at the Engineers discretion.

2. Measure total solids content for concrete sealer. Test results indicating solids content less than Manufacturer's certified solids content used in NCHRP 244 testing will be cause for rejection of all Work corresponding to test sample.
3. Concrete sealer material will be "fingerprinted" using infrared spectra analysis. Sample infrared spectra data not corresponding to NCHRP 244 infrared spectra data will be cause for rejection of all Work corresponding to test sample.

I. Sewer Drains
1. At the contractor's expense and responsibility, Contractor shall prior to slab placement provide a digital file of a video recording of the main sewer line that there are no obstructions to the main line outside of the building.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 01 45 28

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality Control
B. Temporary utilities.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers, enclosures, and fencing.
E. Security requirements.
F. Vehicular access and parking.
G. Waste removal facilities and services.
H. Project identification sign.
I. Field offices.
J. Fire Protection
K. Contractor Life Safety Measures

1.02 RELATED REQUIREMENTS

A. Section 01 35 53 - Security Procedures
B. Section 01 58 13 - Temporary Project Signage.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

1.04 QUALITY CONTROL

A. Regulations:
   1. Comply with governing regulations for the installation and use of temporary construction facilities, and operation of security and protection facilities, including health and safety regulations.
   2. Comply with pollution, environmental protection, and conservation regulations for the use of water and energy, and for the control of dust, air pollution, noise, trash and similar nuisances.
   3. Contractor shall assign responsibilities for installation and maintenance of temporary facilities, security and protection, and compliance with regulations.

B. Job Conditions:
   1. Scheduled Uses: Provide temporary construction facilities and temporary controls at the time first needed to avoid delays in the performance of the work. Maintain, expand, and modify as needed through the progress of work.
   2. Condition of Use: Operate, maintain, control, and protect temporary construction facilities and temporary controls in a manner which will prevent over-loading, freezing, pollution, contamination of water source, flooding, unsanitary conditions, hazardous exposure, fire, disease, erosion of site, damage, or deterioration of completed work, public nuisances, trash, and similar deleterious effects.

1.05 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
B. Existing facilities may not be used.
C. New permanent facilities may be used.

D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

E. Electricity, Lighting
   1. Provide service required for construction operations, with branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords. Comply with applicable codes. Contractor shall pay for all electrical service costs throughout the duration of construction.
   2. Provide lighting for construction operations which shall be adequate to permit workmen to properly perform their work. Comply with applicable codes.
   3. Permanent lighting may be used during construction provided contractor assumes full responsibility for the system. Maintain lighting and make routine repairs.
   4. Installation shall be in accordance with temporary power requirements of National Electrical Code.

F. Heat, Ventilation
   1. Provide as required to maintain specified conditions for construction operations, to protect materials and finishes from damage due to temperature or humidity.
   2. Prior to operation of permanent facilities for temporary purposes, verify that installation is approved for operation, and that filters are in place.
   3. Provide ventilation of enclosed areas to cure materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors, or gases.

G. Water
   1. Provide service required for construction operations. Extend branch piping with outlets located so that water is available by use of hoses.
   2. Contractor shall make the necessary arrangements with the City and pay all charges for the equipment, the installation and the cost of water consumed.
   3. Permanent water system may be used as a source of water supply for construction purposes provided Contractor assumes full responsibility for the maintenance of the system and pays for the cost of water consumed.

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 SECURITY

A. Provide security program to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.11 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

F. Do not allow vehicle parking on existing pavement.

1.12 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 PROJECT IDENTIFICATION

A. Provide 6’ x 8’ Project identification sign of wood frame and exterior grade plywood construction, painted, with exhibit lettering by professional sign painter, to Architect's design and colors. List title of Project, names of Owner, Architect, Consulting Engineers and Contractor. Include Owner and Architect logos. Include architect’s rendering or elevation when available in jpg format.

B. Erect on site at location established by Architect.

C. No other signs are allowed without Owner permission except those required by law.

D. Provide sign showing address of project per fire department requirements. Locate as directed by fire department.

1.14 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.15 FIRE PROTECTION

A. Comply with the city ordinances for fire protection. Maintain access to fire hydrants.

B. Provide adequate fire extinguishers on the premises during construction, of the type and sizes recommended by the NFPA to control fires resulting from the work being performed, Instruct employees in their use. Place extinguishers in the immediate vicinity of the work being performed, ready for instant use. In the use of especially hazardous types of equipment, such as acetylene torches, welding equipment, tar pots, kettles, etc., no work shall be commenced, or equipment used unless fire extinguishers of an approved type and capacity are placed in the working area and available for immediate use by the workmen using the above-mentioned equipment.

C. Fire extinguishers shall be maintained throughout all accessible areas. Provide one approved 2-1/2-gallon foam type extinguisher in the construction shed and in the space where paint or oil, etc., is stored. Other special features of hazard shall be provided with special extinguisher protection as may be warranted.

D. Store combustible materials in fire-safe locations and containers.

1.16 CONTRACTOR LIFE SAFETY MEASURES

A. The Contractor is required to follow strict guidelines for compliance with licensing regulations where construction occurs adjacent to existing facilities. These life safety measures apply to safety, separations, and means of egress around and within the construction area. The Contractor is required to monitor and enforce compliance with these measures. Specific requirements will be reviewed at monthly meetings with Contractors, the Owner, and the Architect.

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

1.18 PROTECTION OF INSTALLED WORK

A. Protect installed work. All installed work that is damaged as decided by the Architect or Owner shall be replaced at contractor’s cost.

B. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors, stairs and other surfaces from traffic, dirt, damage and wear or movement of heavy objects.

D. Prohibit traffic and storage on lawn and landscaped areas.

E. Always provide and maintain pumping facilities, including power for keeping the site, excavations, and structure free from accumulations of water whether from underground seepage, rainfall, drainage, or broken lines. No water shall be allowed to accumulate anywhere near the foundation.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 50 00

PART 1 GENERAL

PART 2 PRODUCTS

2.01 OWNER AND ARCHITECT/ENGINEER OFFICE

PART 3 EXECUTION

3.01 INSTALLATION

END OF SECTION 01 52 13

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

A. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.

B. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

J. Open Water: Prevent standing water that could become stagnant.

K. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Include:
      a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
      c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
      d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
      e. Other information required by law.
      f. Format required by law is acceptable, provided any additional information specified is also included.
   2. Obtain the approval of the Plan by authorities having jurisdiction.
   3. Obtain the approval of the Plan by Owner.

C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 3 EXECUTION

2.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

2.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

2.03 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Clean out temporary sediment control structures weekly and relocate soil on site.

D. Place sediment in appropriate locations on site; do not remove from site.

2.04 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 57 13

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

A. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 3 EXECUTION

2.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. Do not store construction materials or waste in mechanical or electrical rooms.

D. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

E. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

F. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION 01 57 19

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products Specified as Basis-of-Design: Submit substitution requests for unnamed products to Architect for evaluation.

2.02 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

F. Comply with manufacturer's warranty conditions, if any.

G. Do not store products directly on the ground.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project. (**Cutting and patching of any area on structural slab is included**)
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.

D. Digital Video Recording of a video of the main sewer line and each drain at each building to confrim that there are no obstructions to the main lines of each building. - At the Contractor's expense and responsibility.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained

and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations, and _____.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

A. Execute final cleaningprior to Substantial Completion and Final Project Inspection.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

C. **Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.**

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

F. If because of acts or omissions of the Contractor, the Architet is required to conduct more than one substantial completion inspection or final inspection of the project, Architect will enter into a separate agreement with the Owner for the aditional services required and such costs will be deducted from the money still due to the Contractor.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

I. Final Checkout of Structure and Equipment with Owner: Before acceptance and final payment, at a time arrived at with the Owner, a complete checkout and test shall be made of all mechanical and electrical systems, architectual and structural devices, etc., with the Owner. For this purpose, each trade concerned shall provide a skilled operating engineer or technician for a period of at least one day. This person, together with selected operating personnel, shall test all systems and devices and demonstrate the complete operation and required maintenance of each.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 70 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field engineering services by Contractor.

B. Land surveying services by Contractor.

C. Construction surveying by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 01 21 00 - Allowances: Cash, testing, and contingency allowances for field engineering services.

B. Section 01 22 00 - Unit Prices: Bid pricing for hourly salary-and-benefits rates for personnel providing field engineering services if required.

C. Section 01 23 00 - Alternates: Bid pricing for field engineering services, if required.

1.03 DESCRIPTION OF SERVICES

A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.

B. Sole responsibility for establishing all locations, dimensions and levels of items of work.

C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.

D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.

E. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
   1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.

F. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
   1. Major equipment and materials installed as part of the work.
   2. Location of areas in which construction was performed.
   3. Work performed, including field quality control measures and testing.
   4. Weather conditions.
   5. Instructions received from Architect or Owner, if any.

G. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.

1.04 REFERENCE STANDARDS

A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology; 1998.

B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks; 1998.

C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement; 2002.

D. State Plane Coordinate System for the State in which the Project is located.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Submit in addition to items required in Section 01 70 00 - Execution and Closeout Requirements.

C. Informational Submittals: Submit the following:
   1. Field Engineering: Submit daily reports, with content as indicated in this section.
   2. Final property survey.

1.07 QUALITY ASSURANCE

A. Field Engineer's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.

B. Land Surveyor's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.

C. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.

D. Minimum accuracy for required work is as follows:
   1. Grade: Horizontal Tolerance: Plus or minus 0.5 feet (152 mm), Vertical Tolerance: Plus or minus 0.05 feet (15 mm).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify layout information shown on drawings in relation to property survey and existing benchmarks.

B. Notify Owner’s representative and Architect of discrepancies immediately in writing before proceeding to lay out work.

C. Locate and protect existing benchmarks, base lines, and demarcations. Preserve permanent reference points during construction.

D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

3.02 FIELD ENGINEERING

A. Maintain field office files, drawings, specifications, and record documents.

B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.

C. Prepare layout and coordination drawings for construction operations.

D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.

E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.

F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.

G. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner’s concurrence of the remediation plan.

H. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with shop drawings and Contract Documents requirements.

I. Check all bracing and shoring for structural integrity and compliance with designs prepared by the Contractor.

3.03 LAND SURVEYING

A. General: Follow standards for geospatial positioning accuracy.
   1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
   2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
   3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.

B. Coordinate survey data with the State Plane Coordinate System of the State in which the Project is located.

C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in the State in which the Project is located, and approved by the Architect.
   1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

3.04 CONSTRUCTION SURVEYING

A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
   1. Alignment Staking: Provide alignment stakes at 50 foot (15.24 m) intervals on tangent, and at 25 foot (7.62 m) intervals on curves.
   2. Slope Staking: Provide slope staking at 50 foot (15.24 m) intervals on tangent, and at 25 foot (7.62 m) intervals on curves. Re-stake at every ten-foot difference in elevation.
   3. Structure: Stake out structures, including elevations, and check prior to and during construction.
   4. Pipelines: Stake out pipelines including elevations, and check prior to and during construction.
   5. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
   6. Road: Stake out roadway elevations at 50 foot (15.24 m)50-foot intervals on tangent, and at 25 foot (7.62 m) intervals on curves.
   7. Easement Staking: Provide easement staking at 50 foot (15.24 m) intervals on tangent, and at 25 foot (7.62 m) intervals on curves. If required by project conditions, provide wooden laths with flagging at 100 foot (30.48 m) intervals.
   8. Record Staking: Provide permanent stake at each blind flange and each utility cap is provided for future connections. Use stakes for record staking of material(s) acceptable to Architect.
   9. Structural Frame: Upon completion, certify location and plumbness.

B. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.

C. Accuracy:
   1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
      a. Accuracy of Other Staking: Plus/minus 0.04 foot (12.2 mm) horizontally and plus/minus 0.02 foot (6.1 mm) vertically.

b. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.

2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

3.05 REPORTS

A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.06 RECORDS

A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.

1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the State in which the Project is located. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.

2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.

B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

END OF SECTION 01 71 23

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
   1. Provide one copy of Record drawings to the Architect and Owner for approval prior to Substantial Completion. Upon receipt of approval of the Record Drawings, deliver the orginal mark ups, one set of prints, and an el

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.
6. Mechanical and Electrical Record Drawings shall indicate exact routing of all piping, duct work, power, and control wiring, etc., location and function of all controls and whether manual or automatic, normal amperage readings for all motors taken at the equipment under normal load conditions, final air quantities for each air outlet and at each air return.
7. Shall contain the names, addresses and phone number of Subcontractors and shall be signed by the Contractor.

G. Provide to the Owner and Architect a record electronic file of photos detailing the building exterior along with each room photo, clearly labeled and named, by room name and number. Provide a minimum of two photos per room, and more for details, cabinets, and large rooms.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

H. Include test and balancing reports.

I. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. The Contractor shall warranty all work to the Owner for a period of one year from the date of Certificate of Substantial Completion unless required for a longer period by Owner Contractor agreement or other Documents. In the case of work performed by a subcontractor the Contractor shall warranty the work to and in favor of the Owner. Each subcontractor shall warranty their work for a period of one year or as otherwise as noted, after the date of Certificate of Substanital completion. Work that proves to be defective in workmanship and/or materials shall be repaired without expense whatsoever to the Owner.

END OF SECTION 01 78 00

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. All Animal miscellaneous equipment.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Section 01 91 13 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

C. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Provider.
   2. Submit one copy to the Commissioning Provider, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Provider.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Provider in preparation of overall Training Plan; submit in editable .rtf or .docx electronic format unless otherwise approved.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Provider for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
4. Include Commissioning Provider's written acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Provider will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Provider.

E. Provide training in minimum two hour segments.

F. The Commissioning Provider is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 79 00

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PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Provider are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Functional Completion.

C. The Commissioning Provider directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Provider's responsibilities.

D. The Commissioning Provider is employed by Owner.

E. The Commissioning Provider is employed by Contractor.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Provider, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Provider, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Provider.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Provider in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable .rtf or .docx electronic format.
   5. As soon as possible after submittals made to Architect are approved, submit copies of approved submittals to Commissioning Provider.

B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.
   5. Factory test reports.

6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

B. HERS (Home Energy Rating System) Rater: Residential Energy Services Network (RESNET) certified professional.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F (0.3 degree C) and resolution of plus/minus 0.1 degree F (0.05 degree C).
2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
1. Dataloggers required for Functional Tests will be provided by the Commissioning Provider and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Provider has prepared the Commissioning Plan.
1. Attend meetings called by the Commissioning Provider for purposes of completing the commissioning plan.
2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Provider within 60 days after award of contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
4. Provide sufficient notice to Commissioning Provider for delivery of relevant Checklists and Functional Test procedures to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Provider.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.
   4. All preliminary Prefunctional Checklists are included in Contract Documents; the Commissioning Provider has the authority to modify these and will furnish final versions as applicable.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Provider is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.

6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Provider within 2 days of completion.

C. Commissioning Provider is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
2. Provide all additional information requested by Commissioning Provider to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Provider may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Provider Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Provider immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Provider is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Provider will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Provider; the Commissioning Provider will reschedule the test, and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Provider personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Provider personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Provider with input by and coordination with Contractor.
2. Examples of Functional Testing:
    a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
    b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
    c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
    d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Provider is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Architect beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate, and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.

6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
a. Major equipment.

b. Life-safety-critical equipment.
c. Prefunctional Checklist execution.

3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, the Commissioning Provider may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Provider's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
2. Other points will be monitored by the Commissioning Provider using dataloggers.
3. At the option of the Commissioning Provider, some control system monitoring may be replaced with datalogger monitoring.
4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Provider for review; make changes recommended by Commissioning Provider.

D. Commissioning Provider will add commissioning records to manuals after submission to Owner.

END OF SECTION 01 91 13

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PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Provider's (CxP's) responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this verification.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests performed by Contractor and witnessed by the CxP are utilized to achieve this verification.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed O&M data submittals are specified.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is specified.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems; 2025.

1.04 SUBMITTALS

A. Commissioning Plan:
   1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Provider contract.
   2. Submit revised draft to be included in the construction Contract Documents, not less than 4 weeks prior to bid date.
   3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. List of Prefunctional Checklists to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
   3. Submit final list not more than 60 days after start of construction.

C. Prefunctional Checklists:
   1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
   3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

D. List of Functional Test procedures to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in Contract Documents; this is intended to be a list of titles, not full description of the tests.
   3. Submit final list not more than 60 days after start of construction.

E. Functional Test Procedures:
   1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
   3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

F. Training Plan.

G. Recommissioning Manual: Submit within 60 days after receipt of Owner's instructions to proceed with preparation.

H. Commissioning Process Record: Submit to Contractor for inclusion with O&M manuals. Include, at a minimum the following:

I. Final Commissioning Report: Submit to Owner. Include the following:

PART 3 EXECUTION

2.01 COMMISSIONING PLAN

A. Prepare and implement the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
   1. Call and chair meetings of the Commissioning team when appropriate.
   2. Give Contractor sufficient notice for scheduling commissioning activities.
   3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
   4. ASHRAE Guideline 1.1 may be used as a guide for the Commissioning Plan.
   5. Avoid replication of information included in the construction Contract Documents to the greatest extent possible.

B. Review the construction Contract Documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of Commissioning Provider (CxP) in preparing the Commissioning Plan.

C. Commissioning Schedule:
   1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
   2. Contractor's scheduling responsibilities are specified in the construction Contract Documents.
   3. Revise and re-issue schedule monthly.
   4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

2.02 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Review Architect's general commissioning specifications and submit comments to Owner.
   1. These specifications include:
      a. Procedures applicable to all types of items to be commissioned.

2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction Contract Documents by Architect:
    a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
    b. Additional Owner personnel training.
    c. Additional operation or maintenance data that should be submitted.

B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.
1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.
2. The Checklist forms are intended to be part of the Contractor's Contract Documents.

C. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Owner and Architect.
1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
2. The forms the Commissioning Provider will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction Contract Documents.

E. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction Contract Documents

2.03 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.
1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.
2. Identify each Checklist by using Contract Documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.
3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.
4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.
5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
6. Include line items for each physical inspection to be performed.
7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.

B. Prefunctional Checklists - Format:

1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
   a. "This Checklist is submitted for approval with no exceptions."
   b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

2.04 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to demonstrate that functional performance is in accordance with Contract Documents, including proper operation through specified modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load regimes.
   1. Obtain assistance and review by installing subcontractors.
   2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
   3. Include test setup instructions, description of tools and apparatus, special cautions, and.
   4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
   5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring, or manual functional testing.
   6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.

B. Functional Test Forms: Prepare and distribute forms in advance of testing. Use a consistent format to the greatest degree practicable. For each form, include the following:
   1. Signature Block: Signature of the designated commissioning lead and the system and equipment installer attesting that the recorded test results are accurate.

2.05 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager; ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review proposed commissioning schedule, activities, and responsibilities with parties involved. Require attendance by every member of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least monthly.

E. Submit periodic progress reports to Owner and Contractor.

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:
   1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
   2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
   3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
   4. Review TAB Plan prepared by Contractor.
   5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
   6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
   7. Analyze trend logs and monitoring data to verify performance.

M. Witness and document testing of systems and components over which the Commissioning Provider does not have direct control, such as smoke control systems, tests contracted directly by Owner, and tests by manufacturer’s personnel; include documentation in O&M manuals.

N. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Provider rather than the Contractor, perform such testing without assistance of Contractor.

O. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

P. Operation and Maintenance Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

Q. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

2.06 TRAINING

A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.
   1. Include a ____-hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
   2. Include ____-hour session by CxP on the use of the blank Prefunctional Checklists and Functional Test forms for re-commissioning purposes.
   3. Establish criteria for determining satisfactory completion of training.

B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

2.07 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
   1. Include the Final Commissioning Plan and Final Report.
   2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
      a. Design intent documentation, furnished by Architect or others.
      b. Detailed operational sequences.
      c. Startup plan and approved startup reports.
      d. Filled out Prefunctional Checklists.
      e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
      f. Training plan and training records.
      g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:
   1. Executive summary.
   2. List of participants and roles.
   3. Brief facility description.
   4. Overview of commissioning scope and general description of testing and verification methods.
   5. For each item commissioned, an evaluation of adequacy of:
      a. The product itself; i.e. compliance with Contract Documents.
      b. Installation.
      c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
      d. O&M documentation, including design intent.
      e. Operator training.
   6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
   7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
   8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
   9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

2.08 POST-OCCUPANCY PHASE

A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.

B. On-Site Review: 10 months after Substantial Completion conduct on-site review with Owner's staff.
   1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
   2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
   3. Make suggestions for improvements and for recording these changes in the O&M manuals.

4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION 01 91 14

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 03 30 00 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2024.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Samples: Submit samples of underslab vapor barrier to be used.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Underslab Vapor Barrier:
   1. Water Vapor Permeance: Not more than 0.010 perms (0.6 ng/(s m2 Pa)), maximum.
   2. Thickness: 15 mils (0.4 mm).
   3. Product:
      a. Pango Wrap Termite Vapor Barrier byStego Industries LLC: www.stegoindustries.com/#sle.
         1) Contact: Zack Dunnam; zackdunnam@stegoindustries.com; (214) 642-1716
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches (150 mm) and seal using Pango Tape.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder in accordance with manufacturer's before covering with other materials.

G. Penetrations for Pango Termite/Vapor barrier: Pango Claw, Pango Bond, and Pango Term Bar as as marketed by Stego Industries.

H. Perimeter/edge seal: Pango Claw, Pango Bond, and Pango Term Bar all as marketed by Stego Industries.

I. Pentration Prevention: Beast Foot and Beast Form Stake by Stego Industries.

J. Vapor Barrier-Safe Screed System: Beast Screed and Beast Hook by Stego Industries.

3.03 QUALITY CONTROL/ASSURANCE

A. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in person or digital, of the vapor barrier installation. Manufacturer's representative to provide a report that approves the installation based on their site visit or digital review.

B. Provide summary of test results per paragraph 9.3 of ASTM E1745.

C. All mandatory ASTM E1745 testing must be performed on a signle production roll per ASTM E1745 Section 8.1.

D. Termite/Vapor barrier manufacturer must warrant in writing that the termite barrier (a) will prevent subterranean termite infestation caused by termite penetration of the termite/vapor barrier for a period of five (5) years from the Date of Installation; (b) is constructed without the use of chemical termiticides; (c) complies with the designated ASTM E1745 classification for the Life of the Building, and (d) no manufacturing defects in the product for, at least, the Life of the Building.

E. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

F. Manufacturer’s installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.

END OF SECTION 03 05 16

PART 1 GENERAL

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

END OF SECTION 03 10 00

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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 specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Concrete toppings.

B. WORK INCLUDED

1. Design, fabrication, erection, and stripping of formwork for cast-in-place concrete including shoring, reshoring, falsework, bracing, proprietary forming systems, prefabricated forms, void forms, permanent metal forms, bulkheads, keys, blockouts, sleeves, pockets, and accessories. Erection shall include installation in formwork of items furnished by other trades.
2. Furnish all labor and materials required to fabricate, deliver and install reinforcement and embedded metal assemblies for cast-in-place concrete, including steel bars, welded steel wire fabric, ties and supports.
3. Furnish all labor and materials required to perform the following:
   a. Cast-in-place concrete
   b. Concrete mix designs
   c. Grouting structural steel baseplates

C. Related Sections include the following:

1. Division 32 Section “Concrete Paving” for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, Slag Cement, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture, submit proposed mix designs in accordance with ACI 318 requirements. Each proposed mix design shall be accompanied by a record of past performance.

1. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
2. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1. Do not reproduce the structural drawings for use as shop drawings.
2. Embedded metal assemblies: Submit shop drawings for fabrication and placement. Use standard AWS welding symbols.
3. Include construction joint dowels, baskets.

D. Steel Reinforcement Submittals for Information: Mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.

E. Formwork Shop Drawings: Prepared and sealed by a qualified professional engineer, licensed in the State where the project is located, detailing fabrication, assembly, and support of formwork.
1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

F. Welding certificates.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates.

H. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials
2. Admixtures
3. Form materials and form-release agents
4. Steel reinforcement and accessories
5. Waterstops
6. Curing compounds
7. Floor and slab treatments
8. Bonding agents
9. Adhesives
10. Vapor retarders
11. Joint-filler strips
12. Repair materials

I. Submit manufacturer's certification of maximum chloride ion content in admixtures.

J. Fly ash: Submit certification attesting to carbon content and compliance with ASTM C618.

K. Construction Joint Layout: Submit a diagram of proposed construction joint locations for horizontal framing that exceed the limits of a single placement as stated in the structural notes, other than those indicated on the Drawings.

L. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

M. Slab-on-grade construction joint layout and pour sequence drawings.

N. Field quality-control test and inspection reports.

O. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Owner may engage a qualified independent testing agency to perform material evaluation tests.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

C. Store all proprietary materials in accordance with manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    a. High-density overlay, Class 1 or better.
3. Steel Forms

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Protection Board: For use over void forms under structural slabs. Hard-pressed cellulose fiber board, 1/8 inch minimum thickness.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Source of Steel Producers: In accordance with Section 2252.202 of the Texas Government Code steel shall be produced in the United States.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

D. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

E. Deformed-Bar Anchor: ASTM A1064/ A1064M.

F. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For slabs on grade and slabs on void forms, provide sand plates, horizontal runners, or precast concrete blocks on bottom where base material will not support chair legs or where vapor barrier has been specified.

2.5 MECHANICAL SPLICES

A. Provide mechanical splices designed to develop, in tension and compression, 125 percent of the minimum ASTM specified yield strength of the smaller bar being spliced. The following splicing systems are acceptable:

1. Erico "Cadweld T-Series"
2. Erico "Lenton"
3. Dayton Barsplice "Bar-Grip"
4. Dayton Barsplice "Grip-Twist"

2.6 DOWEL BAR ANCHORS

A. Provide dowel bar anchors and threaded dowels designed to develop, in tension and compression, 125 percent of the minimum ASTM specified yield strength of the dowel bars. Unless otherwise indicated, anchors shall be furnished with ACI standard 90 degree hooks. Dowels shall be furnished by the anchor supplier. The following dowel splicing systems are acceptable:

1. Richmond Screw Anchor "Dowel Bar Splicer"
2. Erico "Lenton Form Saver"
3. Dayton Barsplice "Grip-Twist"

2.7 EMBEDDED METAL ASSEMBLIES

A. Steel Shapes and Plates: ASTM A36

B. Headed Studs: Heads welded by full-fusion process, as furnished by TRW Nelson Stud Welding Division.

C. Welded Deformed Bar Anchors: ASTM A1064/ A1064M: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

D. Reinforcing Bars to be Welded: ASTM A706.

E. Coatings

1. Epoxy coating for metal assemblies shall be "Hi-Build Epoxoline," as manufactured by the Tnemec Company, Kansas City, Missouri, applied in accordance with manufacturer's recommendations.

2.8 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
    a. Fly Ash: ASTM C 618, Class F or C.
    b. Slag Cement: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: As indicated on drawings.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 1602/C 1602M and potable.

2.9 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.10 WATERSTOPS

A. Waterstops: At all construction joints below grade. "Synko-Flex" Preformed Plastic Waterstop by the Henry Company, Inc., meeting the requirements of Federal Specification SSS-210.

2.11 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A.

1. Membrane shall have the following properties:
    a. Minimum 15 mils thickness.
    b. Permeance Rating: ASTM E96, 0.01 Perms [grains/(ft^2 * hr *- in Hg)] or lower as tested after mandatory conditioning (ASTM E 154 sections 8, 11, 12, 13)
    c. Installation shall be in accordance with ASTM E1643 and manufacturer's instructions.
2. Products:
    a. Carlisle Coatings & Waterproofing, Inc.: Blackline 400.
    b. Epro; Ecoshield-E 15 mil.
    c. Inteplast Group; Barrier Bac VBC-350 Composite Vapor Retarder
    d. Reef Industries; Vaporguard.
    e. Stego Wrap 15 mil, by Stego.
    f. W.R. Meadows, Inc.: Perminator 15 mil.
3. Accessories

a. Perimeter/seam sealing tape for use with membranes that are not self-adhering to the underside of concrete slabs on void forms:
   1) Crete Claw detail tape by Stego Industries, LLC, for adhering vapor retarder membrane to the underside of concrete surface at slabs on carton void forms, 3-inch and 6-inch widths as noted in Part 3.
   2) StegoTack double-sided adhesive tape by Stego Industries, LLC, for adhering membrane to concrete at gradebeams.

b. Manufacturer's recommended standard adhesive or pressure sensitive tape for general use.

2.12 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products:
      a. Axim Concrete Technologies; CATEXOL Cimfilm.
      b. BASF Construction Chemicals – Building Systems; Confilm.
      c. ChemMasters; Spray-Film.
      d. Conspec by Dayton Superior; Aquafilm.
      e. Dayton Superior Corporation; Sure Film (J-74).
      f. Edoco by Dayton Superior; BurkeFilm.
      g. Euclid Chemical Company (The), an RPM company; Eucobar.
      h. Kaufman Products, Inc.; Vapor Aid.
      i. Lambert Corporation; LAMBCO Skin.
      j. L&M Construction Chemicals, Inc.; E-Con.
      k. Meadows, W. R., Inc.; EVAPRE.
      l. Metalcrete Industries; Waterhold.
      m. Nox-Crete Products Group; Monofilm.
      n. Sika Corporation, Inc.; SikaFilm.
      o. SpecChem, LLC; Spec Film.
      p. Symons by Dayton Superior; Finishing Aid.
      q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
      r. Unitex; Pro-Film.
      s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Products:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. BASF Construction Chemicals – Building Systems; Kure 200.
      c. ChemMasters; Safe-Cure Clear.

d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; Aqua Kure-Clear.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100 Clear.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Products:
a. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. BASF Construction Chemicals – Building Systems; Kure-N-Seal WB.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec by Dayton Superior; Cure and Seal WB.
e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
g. Edoco by Dayton Superior; Spartan Cote WB II.
h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
j. Lambert Corporation; Glazecote Sealer-20.
k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
l. Meadows, W. R., Inc.; Vocomp-20.
m. Metalcrete Industries; Metcure.
n. Nox-Crete Products Group; Cure & Seal 150E.
o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
p. TK Products, Division of Sierra Corporation; TK-2519 WB.
q. Vexcon Chemicals, Inc.; Starseal 309.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating**,** certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Products:
a. BASF Construction Chemicals – Building Systems; Kure-N-Seal W.

b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior; High Seal.
d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
e. Edoco by Dayton Superior; Spartan Cote WB II 20 Percent.
f. Euclid Chemical Company (The), an RPM Company; Diamond Clear VOX; Clearseal WB STD.
g. Kaufman Products, Inc.; SureCure Emulsion.
h. Lambert Corporation; Glazecote Sealer-20.
i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
j. Meadows, W. R., Inc.; Vocomp-20.
k. Metalcrete Industries; Metcure 0800.
l. Nox-Crete Products Group; Cure & Seal 200E.
m. Symons by Dayton Superior; Cure & Seal 18 Percent E.
n. Vexcon Chemicals, Inc.; Starseal 0800.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products:
a. BASF Construction Chemicals – Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
g. Lambert Corporation; UV Safe Seal.
h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
i. Meadows, W. R., Inc.; Vocomp-30.
j. Metalcrete Industries; Metcure 30.
k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

2.13 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Sleeves and Blockouts: Formed with galvanized metal, galvanized pipe, polyvinyl chloride pipe, fiber tubes, or wood.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

2.14 REPAIR MATERIALS

A. Repair Mortar – Hand-Applied: Pre-packaged, cement-based, two-component, polymer-modified, trowel-grade mortar, enhanced with penetrating corrosion inhibitor.

1. Compressive Strength: 1200 psi minimum at 1 day; 6000 psi minimum at 28 days when tested according to ASTM C 109.
2. Bond Strength: 1800 psi minimum at 28 days when tested according to ASTM C 882 (Modified).
3. Product / Manufacturer: SikaTop 122 Plus or SikaTop 123 Plus, Sika Corporation, or approved equal.

B. Repair Mortar – Form and Pour or Pump: Pre-packaged, cement-based, single-component, polymer-modified, silica-fume-enhanced, cementitious mortar.

1. Compressive Strength: 3000 psi minimum at 1 day; 6500 psi at 28 days when tested according to ASTM C 109.
2. Bond Strength: 2200 psi at 28 days when tested according to ASTM C 882 (modified).
3. Product / Manufacturer: Sika MonoTop 611, Sika Corporation, or approved equal.

2.15 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Required average strength above specified strength:
    a. Based on a record of past performance: Determination of required average strength above specified strength shall be based on the standard deviation record of the results of at least 30 consecutive strength tests in accordance with ACI 318, Chapter 5.3 by the larger amount defined by formulas 5-1 and 5-2.
    b. Based on laboratory trial mixtures: Proportions shall be selected on the basis of laboratory trial batches prepared in accordance with ACI 318, Chapter 5.3.3.2 to produce an average strength greater than the specified strength f'c by the amount defined in table 5.3.2.2.
        1) Proportions of ingredients for concrete mixes shall be determined by an independent testing laboratory or qualified concrete supplier.
        2) For each proposed mixture, at least three compressive test cylinders shall be made and tested for strength at the specified age. Additional cylinders may be made for testing for information at earlier ages.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 50 percent.
4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Do not use admixtures which have not been incorporated and tested in accepted mixes.

2. Use water-reducing admixture in concrete, as required, for placement and workability.
3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
4. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated on drawings.

2.17 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.18 FABRICATION OF EMBEDDED METAL ASSEMBLIES

A. Fabricate metal assemblies in the shop. Holes shall be made by drilling or punching. Holes shall not be made by or enlarged by burning. Welding shall be in accordance with AWS D1.1.

B. Welding of deformed bar anchors and headed stud anchors shall be done by full fusion process equal to that of TRW Nelson Stud Welding Division. A minimum of two headed studs shall be tested at the start of each production period for proper quality control. The studs shall be capable of being bent 45 degrees without failure.

C. Welding of reinforcement shall be done in accordance with AWS D1.4, using the recommended preheat temperature and electrode for the type of reinforcement being welded. Bars larger than no. 9 shall not be welded. Welding shall be subject to the observance and testing of the Testing Laboratory.

D. Metal assemblies exposed to earth, weather or moisture shall be hot dip galvanized. All other metal assemblies shall be either hot dip galvanized or painted with an epoxy paint. Repair galvanizing after welding with a Cold Galvanizing compound installed in accordance with the manufacturer's instructions. Repair painted assemblies after welding with same type of paint.

2.19 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

1. When air temperature is between 85 and 95 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 95 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

1. Vertical alignment:
   a. Lines, surfaces and arises less than 100 feet in height - 1 inch.
   b. Outside corner of exposed corner columns and control joints in concrete exposed to view less than 100 feet in height - 1/2 inch.
2. Lateral alignment:
   a. Members - 1 inch.
   b. Centerline of openings 12 inches or smaller and edge location of larger openings in slabs - 1/2 inch.
   c. Sawcuts, joints, and weakened plane embedments in slabs - 3/4 inch.

3. Level alignment:
    a. Elevation of slabs-on-grade - 3/4 inch.
    b. Elevation of top surfaces of formed slabs before removal of shores - 3/4 inch.
    c. Elevation of formed surfaces before removal of shores - 3/4 inch.
    d. Lintels, sills, parapets, horizontal grooves, and other lines exposed to view - 1/2 inch.
4. Cross-sectional dimensions: Overall dimensions of beams, joists, and columns and thickness of walls and slabs.
    a. 12 inch dimension or less - plus 3/8 inch to minus 1/4 inch.
    b. Greater than 12 inch to 3 foot dimension - plus 1/2 inch to minus 3/8 inch.
    c. Greater than 3 foot dimension - plus 1 inch to minus 3/4 inch.
5. Relative alignment:
    a. Stairs:
        1) Difference in height between adjacent risers - 1/8 inch.
        2) Difference in width between adjacent treads - 1/4 inch.
        3) Maximum difference in height between risers in a flight of stairs - 3/8 inch.
        4) Maximum difference in width between treads in a flight of stairs - 3/8 inch.
    b. Grooves:
        1) Specified width 2 inches or less - 1/8 inch.
        2) Specified width between 2 inches and 12 inches - 1/4 inch.
    c. Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view - 1/4 inch in 10 feet.
    d. All other conditions - 3/8 inch in 10 feet.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
    1. Class A, 1/8 inch for smooth-formed finished surfaces.
    2. Class B, 1/4 inch] [Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
    1. Install keyways, reglets, recesses, and the like, for easy removal.
    2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide elevation or camber in formwork as required for anticipated formwork deflections due to weight and pressures of concrete and construction loads.

H. Foundation Elements: The sides of all below grade portions of beams, pier caps, walls, and columns shall be formed straight and to the lines and grades specified. Foundation elements shall not be earth formed unless specifically indicated on the Drawings.

I. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

J. Chamfer exterior corners and edges of permanently exposed concrete.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement, anchoring devices, and embedded items.

1. Do not apply form release agent where concrete surfaces are scheduled to receive subsequent finishes which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

a. Spacing within a bolt group: 1/8"

b. Location of bolt group (center): 1/2"

c. Rotation of bolt group: 5 degrees

d. Angle off vertical: 5 degrees

e. Bolt projection: ± 3/8"

2. Headed Studs: Heads welded by full-fusion process, as furnished by TRW Nelson Stud Welding Division.

3. Welded Deformed Bar Anchors: ASTM A1064/ A1064M: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

3.3 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

B. Lap joints 6 inches and seal with tape as noted below.

1. Vapor retarder membrane seal at slabs on void forms for use with membranes that are not self-adhering to the underside of concrete slabs: Seal vapor retarder membrane to underside of slab using perimeter/seam seal tape applied continuously to perimeter of vapor retarder membrane at grade beams (3in. tape) and at the seams at interior conditions (6in. tape).

a. Apply double-sided adhesive tape top surface of grade beam and adhere membrane to tape. Refer to the drawings for detail.

b. Remove any dirt or debris from membrane prior to application of sealing tape.

2. General sealing and at slabs on grade: Use manufacturer’s standard adhesive or pressure sensitive tape for sealing membrane at seams, pipe penetrations, tears, etc.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated. Only steel conforming to ASTM A706 may be welded.

D. Installation tolerances:

1. Top and bottom bars in structured slabs, girders, beams and joists:

a. Members 8" deep or less: ±3/8"

b. Members more than 8" deep: ±1/2"

2. Concrete Cover to Formed or Finished Surfaces: ±3/8" for members 8" deep or less; ±1/2" for members over 8" deep, except that tolerance for cover shall not exceed 1/3 of the specified cover.

E. Concrete Cover: Refer to the Structural Notes.

F. Splices: Provide standard reinforcement splices by lapping and tying ends. Comply with ACI 318 for minimum lap of spliced bars where not specified on the documents.

G. Mechanical Splices: Use for splicing of bars larger than no. 11 or where no. 11 bars are spliced to larger size bars and where indicated on the drawings. Comply with manufacturer's instructions for preparation of bars and installation procedures.

H. Field Welding of Embedded Metal Assemblies: All paint and galvanizing shall be removed in areas to receive field welds. All areas where paint or galvanizing has been removed shall be field repaired with the specified paint or cold galvanizing compound, respectively.

I. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

J. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs unless otherwise indicated.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, and only if specifically noted as withheld on the batch ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
2. Water content shall not exceed the maximum specified water/cement ratio for the mix.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
4. Do not permit concrete to drop freely any distance greater than 20'-0" for concrete containing a high range water reducing admixture (superplasticizer) or 5'-0" for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be

pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.

5. Pump priming grout shall be discarded and not used in the structure.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 305.1 and as follows:

1. Maintain concrete temperature below 95 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

1. Housekeeping pads: Concrete fill shall be normal weight concrete (3000 psi), reinforced with 4x4-W2.1xW2.1 welded wire mesh set at middepth of pad. Trowel concrete to a dense, smooth finish. Set anchor bolts for securing mechanical or electrical equipment during pouring of concrete fill.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

1. Mix one part Portland Cement and two parts crushed stone or gravel passing 3/8" sieve and retained on a 1/8" sieve, measured by volume with only sufficient water to produce a dry consistency for proper placing and finishing.
2. Placing: Place fill and reinforcement in all steel pan treads and landings. Reinforcement shall be 4x4-W2.1xW2.1 welded wire mesh extending over the area of each tread and landings. Support reinforcement 3/4" above bottom of steel pans. After sufficient hardening of the concrete fill, steel trowel the exposed surface to a smooth finish.
3. Abrasive aggregate: Sprinkle abrasive aggregate into the troweled concrete fill in two shakes at the rate of 1/4 pound per square foot and trowel lightly into the surface.

E. Protective slabs ("Mud slabs"): Concrete fill shall be normal weight concrete (2500 psi minimum) with a minimum thickness of 3 1/2". Reinforce protective slabs with 6x6-W2.9xW2.9 welded wire mesh reinforcing. Finish slab to a wood float finish.

3.10 INSTALLATION OF NON-SHRINK GROUT UNDER BASEPLATES

A. Grout under all bearing and baseplates. Comply with manufacturer's instructions. Do not dry pack.

B. Mixing: Use a mechanical mixer. Add only enough water to make grout placeable. Do not mix more grout than can be used in 20 minutes. Under no circumstances shall grout be retempered.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 CONCRETE SURFACE REPAIRS

A. Surface Defects in Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Owner's approval.

B. Contractor shall submit a detailed, descriptive procedure listing proposed pre-packaged repair materials and methods for the repair of surface defects prior to the start of repair work.

C. Patching Mortar: Mix, place and finish pre-packaged repair mortar in accordance with manufacturer’s instructions.

D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, minor honeycombs and rock pockets with no exposed reinforcement, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out minor honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface, 1/4 inch deep minimum. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view using pre-packaged repair mortar so that, when dry, patching mortar will match surrounding color. Patch a test area at

inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include minor spalls, pop outs, honeycombs and rock pockets with no exposed reinforcement, crazing and cracks in excess of 0.01 inch wide that do not penetrate to reinforcement, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with patching mortar. Remove defective areas with clean, square cuts, ¼" deep minimum. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Place, compact, and finish patching mortar to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
8. Unapproved and defective repairs shall be removed and replaced in accordance with requirements provided by the Engineer at no additional cost to the Owner.

3.13 STRUCTURAL REPAIRS

A. Structurally Defective Concrete: Structural defects include spalls, honeycombs or rock pockets with exposed reinforcement, hollow-sounding concrete, cracks that penetrate to the reinforcement or completely through concrete elements, inadequate cover over reinforcement, and other conditions that affect the structural performance or durability of the concrete as determined by the Engineer.

B. Repair structural defects in concrete in accordance with plans, specifications, details, etc. provided by the Engineer.

1. The cost of the additional services provided by the Engineer to prepare the repair documents, and to oversee the repair work shall be borne by the Contractor.

C. Unapproved and defective repairs shall be removed and replaced in accordance with requirements provided by the Engineer at no additional cost to the Owner.

3.14 CLEANUP

A. Imperfect or damaged work or any material damaged or determined to be defective before final completion and acceptance of the entire job shall be satisfactorily replaced at the Contractor's expense, and in conformity with all of the requirements of the Drawings and Specifications.

Removal and replacement of concrete work shall be done in such manner as not to impair the appearance or strength of the structure in any way.

B. Cleaning: Upon completion of the work all forms, equipment, protective coverings and any rubbish resulting therefrom shall be removed from the site. After sweeping floors, wash floors with clean water. Finished concrete surfaces shall be left in a clean condition, satisfactory to the Owner.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner may engage a special inspector and/or a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections may include:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure four cylinders for each composite sample.
        1) Do not transport field-cast cylinders until they have cured for a minimum of 24 hours.
7. Compressive-Strength Tests: ASTM C 39/C 39M;
    a. Test one cylinder at 7 days
    b. Test two cylinders at 28 days
    c. Test one cylinder at 56 days

d. If 4” by 8” cylinders are used, provide 1 additional cylinder at each stage

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
    a. When the strength level of the concrete for any portion of the structure, as indicated by cylinder tests, falls below the specified requirements, the Contractor shall provide improved curing conditions and/or adjustments to the mix design as required to obtain the required strength. If the average strength of the laboratory control cylinders falls so low as to be deemed unacceptable, the Contractor shall follow the core test procedure set forth in ACI 301, Section 1.6. Locations of core tests shall be approved by the Architect. Core sampling and testing shall be at Contractors expense.
    b. If the results of the core tests indicate that the strength of the structure is inadequate, any replacement, load testing, or strengthening as may be ordered by the Architect shall be provided by the Contractor without cost to the Owner.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 03 30 00

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. Finishing slabs-on-grade, monolithic floor slabs, and separate floor toppings.
2. Surface treatment with concrete hardener, sealer, and slip resistant coatings.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete slab construction and finish.
2. Division 5 Section “Expansion Joint Assemblies”
3. Division 7 Section “Joint Sealers”
4. Division 9 Section "Ceramic Tile" for medium-set and thickset mortar beds for tile.
5. Division 9 Section “Floor Sealer” for floor sealer.

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.

1. ACI 301 - Specifications for Structural Concrete for Buildings
2. ACI 302 - Guide for Concrete Floor and Slab Construction
3. ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units).

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

B. Submittals

1. Product Data: Submit manufacturer's data showing compliance with the specifications for the following products:
   a. Concrete hardener
   b. Sealer
   c. Slip resistant treatments

C. Mockups: Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Build mockups approximately 100 sq. ft. in the location indicated or, if not indicated, as directed by Architect.
2. If Architect determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. The Contractor shall call a meeting to review the detailed requirements for floor construction, including the concrete placing techniques, finishing techniques, curing techniques, and the application of floor finishing materials. All contractors involved in the floor installation shall attend the conference.

2. The Contractor shall notify the Owner, Architect and the Structural Engineer at least 10 business days prior to the scheduled date of the conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 FLOOR AND SLAB TREATMENTS

A.

B. Penetrating sealer:

1. At typical levels of open parking garage, penetrating sealer shall be a low viscosity, urethane based sealer having at least 35 percent solids. Acceptable products include "Iso-Flex 611", by Master Builders, "Eucothane" by the Euclid Chemical Company, or approved equal.

2. At top level of open parking garage, penetrating sealer shall be a silane based liquid sealer containing at least 40 percent solids. Acceptable products include "Stifel" by Nox-Crete, "Masterseal SL" and "Iso-Flex 618" by Master Builders, or "Euco-Guard" by The Euclid Chemical Company, or approved equal.

2.3 RELATED MATERIALS

A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

C. Joint Sealant: For sealing control joints and construction joints in parking decks. "Iso-Flex 880 GB" (self-leveling) or "Iso-Flex 881" (non-sag) polyurethane type by the H.S. Peterson Corporation or approved equal. Provide all primers, cleaners and materials required by the manufacturer for the installation of sealant.

D. Sawcut joint filler: Euco 700 epoxy by The Euclid Chemical Company, or approved equal.

PART 3 - EXECUTION

3.1 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Concrete slabs shall be finished as specified below, within the tolerances specified elsewhere in this Section.

1. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations.

2. Screeding: Immediately after placing, slab shall be vibrated and struck off true by double screeding to the required level, at or below the elevation or grade of the finished slabs as indicated on the Drawings. Vibrators shall not be used to spread the concrete. When camber is indicated for slabs supported on formwork, screed to the required camber. Fixed screed guides are recommended where specified surface tolerance exceeds FF25/FL20.

3. Floating: Immediately after screeding, before any excess bleed water is present on the surface, float the surface using long-handled bull floats or darbies.
4. Straightedging: Immediately after screeding and before excess bleed water is present on the surface, straighten the surface using a highway straightedge.

C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
1. Apply scratch finish to surfaces to receive concrete floor toppings.

D. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
2. Locations: All concrete surfaces under waterproofing membrane, setting beds for brick, mud-set tile, pavers, or terrazzo, and noncomposite topping slabs.

E. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view.
2. Locations: Exposed concrete floors not otherwise specified, concrete surfaces under carpets, vinyl tile, thin set tile, wood flooring, elastomeric coatings, and painted concrete floors, and roof slabs that are future floors.

F. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

G. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

H. Heavy Broom Finish: Apply a heavy broom finish to concrete ramps steeper than 7 percent slope, loading ramps, and other locations where noted on the Drawings.
1. Finishing: As soon as the surface of the concrete is sufficiently stiffened, wood float the surface to a true plane with no coarse aggregate visible. Ramp surfaces shall be cross jointed with a Goldblatt Groover (Model #06-314-M7) or equal jointing tool for the entire width of the ramps. Space cross joints at 6" intervals. The concrete surfaces between grooves shall be brushed with a stiff fiber brush to produce uniformly striated surfaces parallel with cross jointing. Grooved joints and brushed finish texture shall be approved by the Architect.

I. Raked Finish: Apply a raked finish to concrete entrance/exit drive ramps exceeding 10 percent, surfaces noted to be intentionally roughened, surfaces to receive a composite topping.

1. Finishing: After screeding to the proper elevation and before final set, the concrete surface shall be roughened to at least 1/4" amplitude with rakes, perpendicular to traffic where applicable.

J. Slip-Resistive Finish: Before final floating, apply slip-resistive [**aggregate**] [**aluminum granule**] finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ftof dampened slip-resistive aggregate over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

K. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.2 FINISHING CONCRETE TOPPING SLABS

A. Poured slabs over precast concrete floor/roof units: Slabs shall be screeded level with the thickness of the poured concrete varying to compensate for the camber of the units. Finish surface as specified.

B. Poured slabs over precast concrete floor/roof units: Slabs shall be placed to a uniform thickness to follow the camber of the units. Where adjacent units have a different camber, place additional concrete as required to raise the finished surface of the lower unit to match that of the higher unit. Finish the surface as specified.

C. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.

1. Screed surface with a straightedge and strike off to correct elevations.
2. Slope surfaces uniformly where indicated.
3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

D. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.

1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
    a. Finish surfaces to specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15, and measure within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface.

b. Finish and measure surface so gap at any point between surface and an unleveled freestanding 10-foot- long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch.

3.3 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.4 CONTROL JOINTS

A. Saw-cut Control Joints: Form weakened-plane control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.

B. Saw-cut Control Joints with Soff-Cut saw: After completion of finishing operation, cut control joints using a "Soff-Cut" brand electric saw along straight lines where called for on the Drawings. Follow manufacturer's instructions in using "Soff-Cut" saw. Sawcutting shall be done within 2 hours after the completion of finishing, but not so soon as to cause raveling of the joint. Cut to depth indicated on the Drawings.

1. After completion of finishing operations, cut control joints along straight lines where called for on the Drawings. Saw cutting shall be done within 4 hours after the completion of finishing, but not so soon to cause raveling of the joint. Cut to the depth indicated on the Drawings.

C. Form joints in concrete floor topping over control joints in base slabs, unless otherwise indicated.

D. Construct control joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.

E. Construct control joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch deep.

F. Tooled Control Joints in Parking Decks: Immediately after initial floating and as soon as the concrete surface has sufficiently stiffened, tool joint grooves in the topping using a Goldblatt Groover, Model #06-314-M7. Locate grooves directly over longitudinal joints between double tee flanges, each side of inverted tee beams, and elsewhere as detailed. Use a chalk line to locate the joint and follow a straightedge to avoid waviness. Schedule an adequate number of finishers to ensure that all of the joints are properly installed while the concrete is still in its plastic state. Sawcutting after the concrete has hardened will not be permitted.

3.5 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least [one] [six] month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

1. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. All floors are subject to measurement for flatness and levelness and shall comply with the following:

1. Slabs shall be flat within a tolerance of 5/16" in 10'-0" when tested with a ten foot long straightedge. Apply straightedge to the slab at 3'-0" intervals in both directions, lapping straightedge 3'-0" on areas previously checked. Low spots shall not exceed the above dimension anywhere along the straightedge. Flatness shall be checked the next work day after finishing.
2. Slabs shall be level within a tolerance of plus or minus 1/4" in 10'-0", not to exceed 3/4" total variation, anywhere on the floor, from elevations indicated on the Drawings. Levelness shall be checked on a 10'-0" grid using a level after removal of forms.
3. Measurement Standard: All floors are subject to measurement for flatness and levelness, according to ASTM E1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System."

B. Two Tiered Measurement Standard: Each floor test section and the overall floor area shall conform to the two-tiered measurement standard as specified herein.

1. Minimum Local Value: The minimum local FF/FL values represent the absolute minimum surface profile that will be acceptable for any one test sample (line of measurements) anywhere within the test area.
2. Specified Overall Value: The specified overall FF/FL values represent the minimum values acceptable for individual floor sections as well as the floor as a whole.

C. Floor Test Sections

1. A floor test section is defined as the smaller of the following areas:
   a. The area bounded by column and/or wall lines.
   b. The area bounded by construction and/or control joint lines.
   c. Any combination of column lines and/or control joint lines.
2. Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines, as defined by ASTM E1155, at a spacing to be determined by the Owner's testing agency.
3. The precise layout of each test section shall be determined by the Owner's testing agency.

D. Concrete Floor Finish Tolerance

1. The following values apply before removal of shores. Levelness values (FL) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
   a. Slabs on Ground:
      1) Floors to be covered with carpet or vinyl tile, unless otherwise specified:
         a) Overall Value FF25/FL20
         b) Minimum Local Value FF17/FL15
      2) Floors to be covered with thin-set tile:
         a) Overall Value FF35/FL25
         b) Minimum Local Value FF24/FL17

3) Mechanical rooms, thickset tile, recessed floors and roof slabs:

a) Overall Value FF20/FL15
b) Minimum Local Value FF15/FL10

E. Floor Elevation Tolerance Envelope:

1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:

a. Slab-on-Grade Construction: +/- 3/4"- Typ. U.N.O.
b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
c. Top surfaces of all other slabs: +/- 3/4"
d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.
e. For Warehouses and Gymnasium floors: All elevation samples shall fall inside a 1/2" deep envelope.

3.7 FIELD QUALITY CONTROL

A. Concrete Floor Flatness and Levelness:

1. Measurement Standard: Floors shall be measured for flatness and levelness according to ASTM E1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." Tolerances are specified in Section 033000.

2. Time Period for Measuring and Reporting: All measurements shall be made by the testing laboratory or designated agency before the end of the next workday after the completion of finishing operations. For structural elevated floors, measurement shall also be made prior to removal of forms and shores. The Contractor shall be notified immediately after the measurements of any section are complete, and a written report of the floor measurement results shall be submitted within 72 hours after finishing operations are complete. The Contractor shall take immediate action to correct any work that is outside the specified tolerances.

3. Measuring Equipment: The concrete surface profile shall be measured using equipment manufactured for the purpose, such as the Dipstick Floor Profiler, as manufactured by the Edward W. Face Company, Norfolk, Virginia, or by other methods specified in ASTM E1155.

4. Floor Test Sections:

a. A floor test section is defined as the smaller of the following areas:

1) The area bounded by column and/or wall lines.

2) The area bounded by construction and/or control joint lines.

3) Any combination of column lines and/or control joint lines.

b. Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines.
c. The precise layout of each test section shall be determined by the testing agency and shall be submitted for the Architect's review and approval.

3.8 REPAIRS

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

B. Remedial Measures for Slab Finish Construction not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

a. The composite overall values of flatness or levelness of any test section or the entire floor installation measure less than specified values.
b. Any individual test sample (line of measurements) measures less than the specified absolute minimum flatness or levelness value.

2. Modification of Existing Surface:
   a. If, in the opinion of the Architect or Owner's representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, the Contractor shall immediately undertake the approved repair method.
   b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair, and time required to make the repair.
   c. Repair method(s), at the sole discretion of the Architect or Owner's Representative, may include grinding (floor stoning), planing, retopping with specified floor leveling compound, or any combination of the above.
   d. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.
3. Removal and Replacement:
   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, the Contractor shall remove and replace the defective work as directed.
   b. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.
   c. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

END OF SECTION 03 35 00

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 04 26 13 - Masonry Veneer: Installation of mortar.

B. Section 04 26 16 - Adhered Masonry Veneer

C. Section 08 11 13 - Hollow Metal Doors and Frames: Products and execution for grouting steel door frames installed in masonry.

1.02 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.

B. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.

C. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

D. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

E. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2026.

F. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2026.

G. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.

H. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

E. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

1.04 QUALITY ASSURANCE

1.05 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 40 00 - Quality Requirements.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.

C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
   1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site. Mix should be controlled in order to reduce efflorescence, limit color variation and keep quality consistent.

B. Mortar Color: As indicated on drawings.

C. Mortar Mix Designs: ASTM C270, Property Specification.

2.02 MATERIALS

A. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

B. Water: Clean and potable.

C. Integral Water Repellent Admixture: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Performance of Mortar with Integral Water Repellent:
      a. Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours:
         1) No water visible on back of wall above flashing at the end of 24 hours.
         2) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
         3) No more than 25 percent of wall area above flashing visibly damp at end of test.
      b. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
      c. Compressive Strength: ASTM C1314; maximum 5 percent decrease.
   2. Use only in combination with masonry units produced with integral water repellent admixture.

D. Water-Repellent and Efflorescence-Control Mortar Mixture: Blended emulsion additive used in water-penetration-resistant and efflorescence-controlled masonry mortar.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 16 inches (400 mm) without consolidating grout by rodding.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

F. Provide written field report from manufacturer representative indicating their on-site visual observation during installation, confirming proper installation.

3.02 GROUTING

A. Perform all grouting by means of low-lift technique. Do not employ high-lift grouting.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches (300 mm).
   2. Limit height of masonry to 16 inches (400 mm) above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00 - Quality Requirements.

B. Test and evaluate mortar in accordance with ASTM C780 procedures.

C. Test and evaluate grout in accordance with ASTM C1019 procedures.
   1. Test frequency: one set for every 10,000 SF wall surface.

END OF SECTION 04 05 11

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this section.

1.02 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

B. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

C. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

1.03 RELATED SECTIONS:

A. Section 04 22 00 – Concrete Masonry Units

B. Section 04 21 13 - Brick Masonry Units

1.04 SUBMITTALS

A. Provide in accordance with Section 01 33 00 (Submittal Procedures)
   1. Product data and installation instructions.
   2. Two sections demonstrating lap joint: Each 18" inch (457 mm) x 14" inch (356 mm))

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Mortar Net USA Ltd, 541 S. Lake Street, Gary, IN 46403
   1. Ph: 800-664-6638 www.MortarNet.com

B. Substitutions: Under provisions at Section 01 60 00

2.02 MATERIALS

A. TotalFlash system consists of: Thermoplastic Vinyl Membrane, manufactured by Mortar Net.; Mortar Net Drainage/Weep System, Mortar Net Stainless Steel Drip Edge, and Mortar Net Termination Bar. <u>This shall be delivered and installed as one total system and not individual components.</u>TotalFlash System
   1. TotalFlash System: The Thermoplastic Vinyl Membrane is a 40-mil polymeric, reinforced, UV stable membrane. TotalFlash system shall be provided in minimum 12” x 5’ panels and pre molded inside and outside corner pieces.
   2. Mortar Collection Device/Weep Tabs:
      a. Recycled polyester material impregnated with UV protection, biocide to resist mold and flame retardant. Woven mesh designed to allow moisture to migrate to the integrated weep tabs; product adhered to the flashing membrane. Color to match masonry and be approved by Architect.
         1) Thickness: 3/8 inch (9.52 mm)
         2) Height: 10 inches (254 mm)
      b. Length: 5 feet (152.4 cm)
   3. Drip Edge (used along brick ledge): 304 Stainless Steel Drip Edge pre-attached to the flashing membrane and designed to divert moisture away from the masonry wall.
      a. 28-gauge (.014) 304 Stainless Steel with formed drip edge
      b. Length: 5 feet (152.4 cm)
      c. Width: 2.0 inches (50.8 mm)
   4. Provide Total Flash system without the stainless-steel Drip Edge as shown and detailed on the Construction Documents above areas where the first masonry course is fully grouted and where Total Flash is used except along the brick ledge. The Total Flash System without the Drip Edge should come from the manufacturer and not removed in the field.

B. Blocknet System - Single Wyth

1. Flashing system for single-wyth concrete masonry walls with visible stainless steel drip edge: BlockNet flashing system as manufactured by Mortar Net Solutions.
    a. Drainage Strip: 28 guage stainless steel, 4" winde by 60" long with formed drip on the face edge and drainage mesh factory attached.
    b. Vertical drainage mesh: 7 inch by 7 inch thick polyester mech.
    c. Sealant: One part polyether acceptable to flashing system manfuacter.

C. Adhesive: Provided with system for lapping TotalFlash sections:
1. Multi-Purpose/Structural Sealant/No Slump/Moisture Cure (Exceeds ASTM C920-94)
2. NO VOC
3. One part
4. Termination Bar: Pre-attached termination bar is designed to fasten flashing system to the substrate or can be tucked into mortar joint.
5. Strip manufactured from high strength corrosion resistance plastic with pre-drilled holes for attachment.
6. Length 5 feet (152.4 cm)
7. Hole spacing 6 inches (152.4 mm)
8. Screws: Provided self-tapping hex head screws designed to allow attachment to Masonry, Wood or Steel Stud.

D. #14 x 1-1/4

E. Minimum 5-foot section

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install Flashing/Drainage System in accordance with Manufacturer’s installation instructions.

B. Install system as required by detailed project drawings for cavity wall drainage or single-wyth walls.

C. Provide flashing membrane system and drainage mat above all openings unless otherwise approved by Architect. The drip edge is not used above the openings, as it is intended to be used along the masonry ledge.

D. Flashing shall be installed flush with the exterior wall and will not function properly if it is too far in or out from the face. Provide a video of an on-site. Water test after going up 4 courses to show that it will drain properly.

E. Provide written field report from manufacturer representative indicating their on-site visual observation during installation, confirming proper installation.

END OF SECTION 04 05 23

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete masonry units
B. Decorative concrete masonry units.
C. Masonry joint reinforcement.
D. Cavity-wall insulation.
E. Mortar and grout.
F. Steel reinforcing bars.
G. Ties and anchorage.
H. Embedded flashing.
I. Flashings.
J. Miscellaneous masonry accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Installation of dovetail slots for masonry anchors.
B. Section 05 12 00: Structural Steel
C. Section 05 50 00 - Metal Fabrications: Loose steel lintels.
D. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
E. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.
C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2026.
D. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.
F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.
G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2026.
H. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2026.
I. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.
J. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.
K. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).
L. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 INFORMATION SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers,

source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for type of product indicated..

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

F. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

G. Manufacturer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1. Maintain one copy of each document on project site.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials. If units become wet, do not install until they are dry.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24” down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24” down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that meet such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Do not build on frozen work
2. Before erecting masonry during temperatures below 40 degrees F, a written statement shall be submitted and approved received of the methods proposed to heat the masonry materials and protect the masonry from freezing as required below.
3. Masonry units shall be kept completely covered and free from frost, ice, and snow at all times. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
4. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-

repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
   2. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
   3. Special Shapes: Provide nonstandard blocks configured for corners.
      a. Provide bull nose units with continuous glazed returns to window and door frames at lintels, corners, jambs, sash, headers, bonding, starter blocks, sill blocks, and other special conditions. Split Face units shall have a smooth return at openings. Bull nose corner units shall be used at all exposed corners and jambs, inside the building.
   4. Load-Bearing Units: ASTM C90, normal weight.
      a. Exposed Faces: Manufacturer's standard color and texture. Double face units shall have the same texture on both sides and shall be the same texture as adjacent units whether the front face is split face, burnished face, or normal (smooth) face. All masonry exposed to view from the exterior shall have integral color and water repellent.
      b. Provide bull nose units with continuous glazed returns to window and door frames at lintels, corners, jambs, sash, headers, bonding, starter blocks, sill blocks, and other special conditions. Split Face units shall have a smooth return at openings. Bull nose corner units shall be used at all exposed corners and jambs, inside the building.
      c. Manufacturers:
         1) The Concrete Products Group; Spec-Brik: www.concreteproductsgroup.com/#sle.
         2) Spectra Glaze; www.spectraglaze.com/#sle.
         3) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MASONRY LINTELS

A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.04 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4” thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
   5. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

E. Grout Aggregate: ASTM C404.

F. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

G. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.

H. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Euclid Chemical Company (The); Accelguard 80.
      b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
      c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, Mortar Tite by Addiment, or the following
      a. ACM Chemistries; RainBloc for Mortar.
      b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
      c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

J. Water: Potable

K. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

2.05 REINFORCEMENT AND ANCHORAGE

2.06 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
   3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
   4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
   5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
   6. Stainless-Steel Sheet: ASTM A 666, Type 304.
   7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   8. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.

B. Corrugated Metal Ties: Metal strips not less than 7/8” wide with corrugations having a wavelength of and an amplitude of 0.06 to 0.10” made from 0.060”- thick, steel sheet, galvanized after fabrication. Use only where Individual ties and adjustable anchors will not work.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8” cover on outside face. Outer ends of wires are bent 90 degrees and extend 2” parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4” wide.
   1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2” long may be used for masonry constructed from solid units.
   2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4”.
   3. Wire: Fabricate from 1/4”- diameter, hot-dip galvanized steel.

E. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4”- diameter, hot-dip galvanized steel wire.

F. Adjustable Anchors for Connecting to Stone: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.109”- thick, stainless-steel sheet.

2.07 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034”, galvanized steel sheet.

C. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

D. Post-installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
   3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.08 FLASHINGS

A. Flashing: Use one of the following unless otherwise indicated:

B. Membrane Non-Asphaltic Flashing Materials:
   1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040” (1.02 mm) thick.
   2. Mortar Net: High-density polyethylene (HOPE), 90% open mesh, dovetail shape. Size as required to fill cavity opening.
   3. BlockNet by Mortar Net for all exterior single wythe masonry walls along foundation. Installed per mfr recommendations, and Block Flash for single wythe wall above solid filled courses such as bond beams and lintels and as required in Section 04 05 23.
   4. Weeps: Weeps shall be formed with weep tabs as part of the Total Flash system.

C. Application: Unless otherwise indicated, use the following:
   1. Where flashing is indicated to receive counter flashing, use metal flashing.
   2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
   3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
   4. Where flashing is fully concealed, use metal flashing.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.09 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints. Must be complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with

ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

B. Compressible Joint Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene PVC.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include the following:
      a. Mortar Net USA, Ltd.; Mortar Net.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

F. Weeps:
   1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2” long.
   2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8” less than depth of outer wythe, in color selected from manufacturer's standard.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Advanced Building Products Inc.; Mortar Maze weep vent.
      b. Blok-Lok Limited; Cell-Vent.
      c. Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
      d. Heckmann Building Products Inc.; No. 85 Cell Vent.
      e. Hohmann & Barnard, Inc.; Quadro-Vent.
      f. Wire-Bond; Cell Vent.

G. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148” steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MORTAR AND GROUT MIXING

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.

B. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

C. Pigmented Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
   1. Pigments shall not exceed 10 percent of portland cement by weight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

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

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. 1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry where applicable on certain projects: Match coursing, bonding, color, and texture of existing masonry.

3.03 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

3.04 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.05 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2” or minus 1/4”.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2”.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4” in a story height or 1/2” total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4” in 10’, or 1/2” maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8” in 10’, 1/4” in 20’, or 1/2” maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4” in 10’, 3/8” in 20’, or 1/2” maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8” in 10’, 1/4” in 20’, or 1/2” maximum.

5. For lines and surfaces do not vary from straight by more than 1/4” in 10’, 3/8” in 20’, or 1/2” maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4” in 10’, or 1/2” maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16” except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8”, with a maximum thickness limited to 1/2”.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8”.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8” or minus 1/4”.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8”. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8”.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16” from one masonry unit to the next.

3.06 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4” horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24” under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.
2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.07 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

5. Along wall of kennels where resting benches are anchored into wall, bottom courses of masonry shall be completely grouted solid.

B. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.08 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft of wall area spaced not to exceed 24” o.c. horizontally and 16” o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12” of openings and space not more than 36” apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24” o.c. vertically.
   2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
      a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
      b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
   3. Header Bonding: Provide masonry unit headers extending not less than 3” into each wythe. Space headers not over 8” clear horizontally and 16” clear vertically.
   4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers

B. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

C. Bond wythes of cavity walls together using bonding system indicated on Drawings.

D. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12” o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks/joints and open gaps in insulation with crack sealer or tape/bed compatible with insulation and masonry.

END OF SECTION 04 20 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Clay facing brick.
C. Ceramic glazed face brick.
D. Mortar and grout.
E. Reinforcement and anchorage.
F. Flashings.
G. Installation of lintels.
H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting.
B. Section 06 10 00 - Rough Carpentry: Wood stud backup for masonry veneer.
C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
C. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.
D. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2024.
E. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2021.
F. ASTM C1405 - Standard Specification for Glazed Brick (Single Fired, Brick Units); 2023.
G. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
H. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 60 00 - Product Requirements, for additional provisions.
    2. Extra Glazed Units: 2% of each type, size, and color combination.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; unless otherwise indicated on drawings. Include mortar and accessories and structural backup

in mock-up. Note that Interior walls shall be constructed for exposed to view on both sides. Mockup shall be constructed with a staggered, or step back approach revealing each piece of the wall system.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

D. The approved sample panel shall be the standard of workmanship.

E. Panel shall not be removed until masonry work as required by this section has been accepted or as directed by the Architect.

F. Use sample panel to test cleaning methods.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

C. Store masonry units on elevated platforms in a dry location. During construction cover tops of masonry, projects, and sills with waterproof sheeting at the end of each day's work. Cover partially completed masonry tops when construction is not in progress.

PART 2 PRODUCTS

2.01 UNIT MASONRY - GENERAL

A. Comply with applicable code for UL Assembly No. ____.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
      a. Provide bullnose units for outside corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
   5. Pre-Faced Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.
      a. Colors and Styles: As indicated.

2.03 BRICK UNITS

A. Manufacturers:
   1. Blackson Brick;[____]: https://www.blacksonbrick.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Color and texture to match Architect's sample.
   2. Color and Texture: Reference Exterior Elevation Drawings and mock-up drawings. Final approval shall be provided upon completion of mockup..

3. Nominal Size: 2-1/4” x 3-5/8” x 7-5/8”.

C. Glazed Brick (Single Fired, Brick Units): ASTM C1405, Grade S (standard), Type I (single-faced units), Class Exterior, Division Solid.
   1. Color and texture: Reference Exterior Elevation Drawings and mock-up drawings. Final approval shall be provided upon completion of mockup.
   2. Nominal size: 2-1/4” x 3-5/8” x 7-5/8”.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.

2.04 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 05 11.

2.05 REINFORCEMENT AND ANCHORAGE

A. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
   3. Vertical adjustment: Not less than 2 inches (50 mm).
   4. Manufacturers:
      a. TruFast Walls, a division of Altenloh, Brinck & Co. US, Inc; Thermal-Grip MVA: www.trufastwalls.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 FLASHINGS

A. Metal Flashing Materials: as specified in Section 04 05 23# .

B. Drip Edge: Stainless steel; compatible with membrane and adhesives.
   1. Manufacturers:
      a. Mortar Net Solutions; Metal Drip Edges: www.mortarnet.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Adhesives, Primers, and Seam Tapes for Flashings: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.07 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Weeps:
   1. Type: Preformed aluminum vents with sloping louvers.
   2. Manufacturers:
      a. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Panels installed at flashing locations.
      a. Manufacturers:
         1) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.

D. Multicomponent Cavity Wall Drainage System: Combination mortar diverter, flashing and weep system.
   1. Membrane Type: Thermoplastic vinyl.
   2. Drip Edge: Galvanized steel with factory applied, high-performance organic coating.
   3. Drip Edge Color: Selected by Architect from manufacturer's standard custom range.
   4. Termination Bar: Polyvinyl chloride (PVC)

5. System Unit Length: 5 feet, 6 inches (1676 mm).
6. Manufacturers:
   a. Mortar Net Solutions; TotalFlash Panel: www.mortarnet.com/#sle.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

3.07 LINTELS

A. Maintain minimum 8 inch (203.2 mm) bearing on each side of opening.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.09 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.10 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with mild detergent cleaning solution.Do not use acid.

D. Use non-metallic tools in cleaning operations.

E. Remove all stains and mortar streaks.

3.11 PROTECTION

A. At the end of each day’s work, cover the tops of walls with canvas or other suitable material weighted down to exclude weather.

END OF SECTION 04 26 13

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PART 2 PRODUCTS

END OF SECTION 04 29 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are indicated on drawings as "cast stone".

1.02 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting: Mortar for setting cast stone.

B. Section 04 20 00 - Unit Masonry: Installation of cast stone in conjunction with masonry.

C. Section 04 29 00 - Engineered Unit Masonry: Installation of cast stone in conjunction with masonry.

D. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

B. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.

C. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2025.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.

H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

I. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

C. Verification Samples: Pieces of actual cast stone components not less than 6 inches (152 mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.05 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Approved mock-up will become standard for appearance and workmanship.

C. Mock-up may not remain as part of the completed work.

D. Remove mock-up not incorporated into the work and dispose of debris.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, as specified in Section 04 05 11 ; do not use masonry cement.

J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.02 SOURCE QUALITY CONTROL

A. Test compressive strength and absorption of specimens selected at random from plant production.
   1. Test in accordance with ASTM C642.
   2. Select specimens at rate of 3 per 500 cubic feet (3 per 14 cubic m), with a minimum of 3 per production week.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.02 TOLERANCES

A. Joints: Make all joints 3/8 inch (9.5 mm), except as otherwise detailed.

1. Rake mortar joints 3/4 inch (19 mm) for pointing.
2. Remove excess mortar from face of stone before pointing joints.
3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
4. Leave the following joints open for sealant:
    a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
    b. Joints in projecting units.
    c. Joints between rigidly anchored units, including soffits, panels, and column covers.
    d. Joints below lugged sills and stair treads.
    e. Joints below ledge and relieving angles.
    f. Joints labeled "expansion joint".

3.03 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).

B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.

C. Repair methods and results subject to Architect 's approval.

3.04 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
    1. Wet surfaces with water before applying cleaner.
    2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
    3. Remove cleaner promptly by rinsing thoroughly with clear water.
    4. Do not use acidic cleaners.

3.05 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION 04 72 00

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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. Structural steel framing members and connections.
2. Deck support angles.
3. Shop prime painting and touch up painting in the field.
4. Temporary construction bracing.
5. Fabrication and erection inspection and testing.

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 1 Section “Submittals” for administrative requirements for the submission of shop drawings and other submittals.
3. Division 5 Section “Architecturally Exposed Structural Steel.
4. Division 5 Section "Steel Deck" for field installation of shear connectors.
5. Division 5 Section "Metal Fabrications" for [**steel lintels or shelf angles not attached to structural-steel frame**] [**miscellaneous steel fabrications**] [**and**] [**other metal items**] not defined as structural steel.
6. Division 5 Section “Metal Stairs”.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand LRFDfactored loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's " Steel Construction Manual, edition as referenced in the Building Code.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Construction: Type PR, partially restrained.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 Section “Submittals”.

B. Submittals for Review

1. Provide complete details and schedules for fabrication and shop assembly of members, erection plans, details, procedures, and diagrams showing sequence of erection of structural steel components.
   a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   b. Include embedment drawings.
   c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

2. Shop drawings and erection drawings shall not be made by using reproductions of Contract Drawings.

3. Structural steel members for which shop drawings have not been reviewed shall not be fabricated. Engineer's review shall cover general locations, spacings, and details of design. Omission from shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though such shop drawings may have been reviewed and returned.

C. Submittals for Information:

1. Product Data: For each type of product indicated.

2. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

3. Connection Calculations: Contractor shall design all connections not specifically detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Texas. Submit design calculations for the connections designed by the contractor, prior to or with the steel shop drawings. Shop drawings containing connections for which calculations have not been received shall be returned unchecked as an incomplete submittal. Calculations shall be retained for the Engineer's file and will not be approved or returned.

a. Connections shall be designed in accordance with the requirements specified in the Structural Drawings and Specifications.
b. Beam connections: Submit a complete calculation for each different beam connection used and detailed on the shop drawings. Conditions which are similar may be grouped together so as to utilize a single connection design.
c. Submit complete connection calculations for wind brace connections, truss connections, moment connections and other connections where specified on the Contract Drawings. Each calculation shall identify the location or locations for which the connection applies, the member mark(s) from the Contract Documents, the piece mark(s) from the shop drawings, the member size, the design loading(s), member size, and the end of the member to which the connection applies.
d. The unit of measurement for the connection calculations must follow the United States customary system (USCS).

4. Welding certificates.

5. Qualification Data: For Installer, fabricator, and testing agency.

6. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

a. Structural steel including chemical and physical properties.
b. Bolts, nuts, and washers including mechanical properties and chemical analysis.
c. Shear stud connectors.
d. Shop primers.
e. Nonshrink grout.

7. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

B. Fabricator Qualifications: Company specializing in performing the work of this section with minimum 10 years of documented experience.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. The latest adopted edition of all standards referenced in this Section shall apply unless noted otherwise. In case of conflict between these Contract Documents and the referenced standard, the Contract Documents shall govern. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.

E. The Contractor shall furnish fabrication and erection inspection and testing of all welds in accordance with AWS D1.1, Chapter 6. Submit records of inspections and tests to the Owner's testing laboratory for their review. The fabrication and erection inspectors shall be AWS certified welding inspectors.

F. All materials, fabrication procedures and field erection are subject to verification inspection and testing by the Owner's testing laboratory in both the shop and field. Such inspections and tests will not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with specified requirements.

G. Qualifications for Welding Work: Contractor shall be responsible for qualifying welding operators in accordance with the AWS "Standard Qualification Procedure." Provide certification to Owner's testing laboratory that welders to be employed in the work have satisfactorily passed AWS qualification tests. Recertification of welders shall be Contractor's responsibility.

H. Qualification of Welding Procedures: Contractor shall provide the testing laboratory with welding procedures which are to be used. Welding procedures shall be qualified prior to use in accordance with AWS D1.1, Part B.

I. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges”
2. AISC's "Specification for Structural Steel Buildings."
3. ASTM A6 "Specifications for General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. RCSC's "Specification for Structural Joints Using High Strength Bolts."
6. AWS D1.1 "Structural Welding Code"
7. SSPC (Society for Protective Coatings), standards as noted.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Source of Steel Producers: In accordance with Section 2252.202 of the Texas Government Code steel shall be produced in the United States.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 50 percent.

C. W-Shapes: ASTM A 992.

D. Channels, Angles: ASTM A 36.

E. Plate and Bar: ASTM A 36.

F. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

G. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: As indicated.
2. Finish: Black, except where indicated to be galvanized.

H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F3125, grade A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A 563 hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

E. Threaded Rods: ASTM A 193.

1. Nuts: ASTM A 563hex carbon steel.
2. Washers: ASTM A 36 carbon steel.
3. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: ASTM A 780.

C. Cold Galvanizing Compound shall be "ZRC" cold galvanizing compound as manufactured by ZRC Worldwide, Marshfield, Massachusetts.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, Grade B, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency

suitable for application and a 30-minute working time, capable of developing a minimum compressive strength of 5,000 psi at 28 days.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges", AISC's "Specification for Structural Steel Buildings", and as indicated on accepted shop drawings.

1. Camber structural-steel members where indicated.
2. Mill tolerances shall conform to ASTM A6. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Plates shall be free of gross discontinuities such as ruptures and delaminations. Plates shall comply with ASTM A578, Level 1.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads. Members in compression joints which depend on contact bearing shall have the bearing surfaces milled to a common plane. Members to be milled shall be completely assembled before milling.

E. Base Plates: Oversize anchor bolt holes in base plates to facilitate erection as specified in Table 14-2 in AISC 360-10.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning, SSPC-SP 2, "Hand Tool Cleaning, or SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F3125, grade A 325 or grade A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.
2. Provide washers over all slotted holes in an outer ply.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work. Welds not

specified shall be continuous fillet welds designed to develop the full strength of the member. A combination of welds and bolts shall not be used to transmit stress at the same face of any connections. Clean completed welds prior to inspection. Slag shall be removed from all completed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Galvanized surfaces.
5. Top surfaces of beams which support composite metal floor deck.
6. Headed shear studs, although overspray is acceptable.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.

B. Galvanizing: The following steel shall be hot-dip galvanized (including any associated fasteners):

1. Lintels and shelf angles attached to structural-steel frame and located in exterior walls.
2. Railing exposed to weather.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM F3125, grade A 325 or grade A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Design of temporary bracing and supports shall be the responsibility of the Contractor. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design," unless closer tolerances are required for proper fitting of adjoining or enclosing materials, in which case the more stringent shall apply.

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
5. Grout under baseplates in accordance with Section 033000.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges," Unless adjoining materials dictate a tighter tolerance.

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated. Any member having a splice not shown and detailed on the accepted shop drawings shall be rejected.

F. Do not field cut or alter structural members without approval of Architect/Engineer. Do not use thermal cutting during erection unless approved by Architect/Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Gas Cutting: Do not use gas cutting torches in the field to correct fabrication errors in structural framing.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F3125, grade A 325 or grade A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.
2. A307 bolts and high-strength (ASTM F3125, grade A325 and grade A490) bolts noted to be "snug-tight" shall be tightened using a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench, bringing the plies into contact.
3. High-strength bolts which are not specifically designated to be "snug-tight" shall be tightened to provide at least the minimum tension shown in Table 4 of the "Specification for Structural Joints using ASTM F3125, grade A325 and grade A490 Bolts." Tightening shall be done by the turn-of-the-nut method, with direct tension indicators, or by properly calibrated wrenches.
4. Bolts tightened with a calibrated wrench or by torque control shall have a hardened washer under the element (nut or bolt head) turned in tightening.
5. Hardened washers shall be placed over slotted holes in an outer ply. Hardened beveled washers shall be used where the outer face of the bolted parts has a slope greater than 1:20 with respect to the bolt axis.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work. Welds not specified shall be continuous fillet welds designed to develop the full strength of the member. A combination of welds and bolts shall not be used to transmit stress at the same face of any connections. Clean completed welds prior to inspection. Slag shall be removed from all completed welds.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM F3125, grade A 325 or grade A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touch-up Cold Galvanizing: Touch up areas of hot dip galvanized members where galvanizing has been abraded during shipping and erection and areas where galvanizing has been removed or damaged due to welding. Apply cold galvanizing compound in accordance with the manufacturer's instructions to a minimum dry film thickness of 2.0 mils.

C. Column bases to be protected from surface rust and weather deterioration. Contractor shall protect bases of columns from rust with a rust inhibitor paint such as bituminous paint or by contractor means.

END OF SECTION 05 12 00

PART 2 PRODUCTS

1.01 GENERAL REQUIREMENTS

A. Comply with Section 05 12 00, except as amended in this section for aesthetic purposes.

1.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Fabricate AESS in accordance with categories defined in AISC 303, as follows:

END OF SECTION 05 12 13

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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. Roof deck.

B. Work Included

1. Furnish all labor and materials required to fabricate, deliver and install steel roof deck and accessories including formed steel cant strips, eave strips, valley strips, sump pans, edge closures, pour stops, reinforcing plates and related accessories.
2. Furnish all labor and materials required to fabricate, deliver and install steel floor deck and accessories including formed steel end closures, edge forms, flashings, and reinforcing plates, headed shear studs, and related accessories.

C. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for structural concrete fill over steel deck.
2. Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.
3. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
2. Product Data: For each type of deck, accessory, and product indicated. Provide deck dimensions, sectional properties, uplift resistance and diaphragm capacity for specified fastener layout and support spacing, and finishes.

B. Submittals for Information:

1. Product Certificates: For each type of steel deck, signed by product manufacturer. Certify that products comply with SDI, UL and ICC standards as specified.
2. Manufacturer’s installation instructions.
3. Welding certificates: For each welder employed on the Work.
4. Field quality-control test and inspection reports.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   a. Power-actuated mechanical fasteners.
6. ICC Evaluation Service Reports: Deck units shall be approved by the International Code Council and shall have a corresponding report from ICC.
7. Deck units shall be classified by Underwriter's Laboratory, Inc. and shall be labeled and marked as required by UL, indicating manufacturer testing and inspection.

1.4 QUALITY ASSURANCE

A. Installer: Company specializing in performing the work of this Section with minimum 5 years documented experience.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. Comply with applicable provisions of the following specifications and documents.

1. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
2. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
3. SDI (Steel Deck Institute) - Design Manual for Composite Decks, Form Decks, Roof Decks.
4. UL - Fire Resistance Directory.

F. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than [**25**] <**Insert number**> percent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source of Steel Producers: In accordance with Section 2252.202 of the Texas Government Code steel shall be produced in the United States.

B. 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:

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

1. Steel Deck:
   a. Canam Steel Corp.;The Canam Manac Group.
   b. Consolidated Systems, Inc.
   c. Epic Metals Corporation.
   d. New Millennium Building Systems, LLC.
   e. Nucor Corp.; Vulcraft Division.
   f. Verco Manufacturing Co.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A, Structural Steel (SS), Grade as indicated, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

1. Mechanical Fasteners: Galvanized hardened steel, self-tapping "Teks" screws, manufactured by Illinois Tool Works, Inc., Buildex Division, or equal. Size shall be #10 minimum, unless noted otherwise.
2. Powder Actuated Fasteners: Zinc coated fastener with .145 inch shank diameter and 1 1/4 inch shank length. X-ENP-19 pin as manufacturer by Hilti, or equal.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, sealed watertight. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: As indicated.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or [**18 inches**] [**36 inches**], and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

F. Architectural finishes and mechanical, electrical, and plumbing equipment shall not be hung directly from the metal deck.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies materials and services required for the design and installation of cold-formed metal frame system including steel studs, with tracks joists and required accessories as required for a complete exterior wall system including furring strips connections, and fasteners. The entire Cold Formed Metal Framing system (including the interior stone wall backup) is the responsibility of a third-party Design Engineer and stamped by a Registered Engineer legally qualified to practice in the jurisdiction where project is located. Contractor shall be responsible for all associated costs. System design shall be coordinated with the cladding support system.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Insulation within framing members.

B. Section 09 21 16 - Gypsum Board Assemblies: Cold-formed steel nonstructural framing.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.

D. Steel Framing Industry Association (SFIA) Certification:
   1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.

E. Design Data:
   1. Shop drawings signed and sealed by a professional structural engineer.

2. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.
3. Details and calculations for factory-made connectors, signed and sealed by a professional structural engineer.

F. Manufacturer Reports: Include research reports indicating compliance with applicable building codes.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications:
1. Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

1.07 MOCK-UPS

A. As inciated in documents, provide independent mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.

B. Mock-up may not remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:
1. CEMCO: www.cemcosteel.com/#sle.
2. ClarkDietrich: www.clarkdietrich.com/#sle.
3. SCAFCO Corporation: www.scafco.com/#sle.
4. Or manufacturer meeting performance requirements.

B. Connectors:
1. Same manufacturer as metal framing.

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, applicable building code, AISI S100, AISI S240, and ASTM C955.

B. Design Criteria: In accordance with applicable codes.
1. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
2. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
1. Structural Grade: As required to meet design criteria.
2. Corrosion Protection Coating Designation: CP 90 in accordance with AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

2.05 CONNECTIONS

A. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

B. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

2.06 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

D. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.

E. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Coordination of Other Tests and Inspections: Owner will employ independent testing agency to test and/or inspect _____; provide access and _____ as required to accommodate timely performance.

END OF SECTION 05 40 00

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 1.02 WORK INCLUDED

A. A. Provide miscellaneous metals, shop fabricated and manufactured in accordance with the schedule.

B. B. Primer.

1.03 RELATED WORK

A. Section 09 90 00 – Painting

1.04 REFERENCES

A. ASTM A36 – Structural Steel.

B. ASTM B26 – Cast Aluminum.

C. ASTM A53 – Steel Pipe, Hot Dipped, Zinc Coated Welded and Seamless.

D. ASTM 500 – Steel Tubing, Cold-formed, Welded and Seamless.

E. FS TT-P_86 – Paint, Ready-Mixed.

F. AWS D1.1 – Structural welding Code.

1.05 SUBMITTALS

A. Submit shop drawings under provisions of Section 01 33 00 indicating in detail, sizes, material and gage, methods of securing and anchoring and finish.
   1. Include erection drawings, elevations and details where applicable.
   2. Indicate welded connections using standard AWS welding symbols.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Miscellaneous Structural Steel: ASTM A36.

B. Cast Aluminum: ASTM B26.

C. Steel Pipe: ASTM 53, Standard Weight.

D. Steel Tubing: ASTM A500, Grade B.

E. Fasteners: Bolts, nuts, washers, screws, expansion shields, suitable for intended use.

F. Finish: Primer for Ferrous Metal: Fast-curing, lead-free, abrasion-resistant, rust-inhibitive primer selected for compatibility with substrates and with types of alkyd-type finish paint systems indicated, and for capability to provide a sound foundation from field-applied topcoats despite prolonged exposure; complying with performance requirements only of FS TT-P-86, Types I, II, and III. Paint exposed to view surfaces unless noted otherwise

2.02 SCHEDULE OF ITEMS

A. Anchors: Unless specifically exempted, provide all sleeves, inserts and bolts required in conjunction with items of work included under this section and under other trades where necessary for securing work in place. Sizes, kinds and spacing of bolts and/or anchors not indicated or specified shall be as directed. Installation of anchors for other trades shall be the responsibility of the respective trades.

B. Miscellaneous Plates and Shapes: Provide items that do not form a part of the structural steel frame work, such as lintels, angles and plates, steel stringers and treads, miscellaneous mountings, and framing as needed to complete the work whether specifically indicated or identified in the Documents. Where indicated and no size is provided, contractor shall bid

accordingly and request clarification prior to construction. No additional cost will be considered. Fabricate items from ASTM A36 steel.

C. Supports for Millwork: Steel brackets and supports for items such as millwork shall be provided for necessary support. Provide angle frames and legs fabricated from 1" x 1" 11 gage steel tubing with 1/8”-thick steel plate anchors welded-on at 45° angles and punched for 1/4” anchors for countertops, unless otherwise indicated. All welds shall be ground smooth.

D. All exposed to view miscellaneous support members shall be primed and painted and all exposed to view, coping, downspouts, flashing, and similar type metals shall be pre-finished.

E. Strapping and banding: Provide all necessary strapping, banding, and bars as required to support items attached to walls such as flashing and counterflashing, Total Flash system, wall supported items, and miscellaneous support and bracing for both interior and exterior metal stud walls

PART 3 – EXECUTION

3.01 GENERAL:

A. Verify all measurements and take necessary field measurements before fabrication. Weld in accordance with AWS Code D1.1. Furnish exposed fasteners on compatible materials, matching color and finish, and harmonizing with the service where applied. Include materials and parts necessary to complete each item. Provide necessary miscellaneous bolts and anchors, supports, braces, and connections. Fabricate or match the necessary rebates, lugs, and brackets to permit neat and substantial assembly. Punch or drill holes for bolts and screws. Use concealed fasteners where practicable. Form weather-exposed joints to exclude water.

3.02 WORKMANSHIP:

A. Form miscellaneous metalwork to shape and size required with sharp lines and angles and true curves. Drill and punch in proper alignment and to match well at mated parts. Weld continuously, except where tack welding is permitted. Make exposed welds continuous and grind smooth. Smoothly finish exposed surfaces of work in place. Cope or miter corner joints. Set work accurately to established lines and elevations and fasten securely.

3.03 SHOP PAINTED

A. All ferrous metals, except those portions embedded in concrete, shall receive a shop coat of primer.

END OF SECTION 05 50 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Stairs with grating treads.

C. Structural steel stair framing and supports.

D. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2024.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

G. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2025.

H. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2026.

I. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2025).

J. ASTM A999/A999M - Standard Specification for General Requirements for Alloy and Stainless Steel Pipe; 2023.

K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

L. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use; 2019 (Reapproved 2024).

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

O. NAAMM AMP 510 - Metal Stairs Manual; 1992.

P. NAAMM MBG 531 - Metal Bar Grating Manual; 2024.

Q. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual; 2024.

R. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Design Data: As required by authorities having jurisdiction.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job-site in a good condition and properly protected against damage to finished surfaces.

B. Store material in a location and manner to avoid damage. Do not stack stair components. Lay out components on firm foundation m

C. Store metal components in a clean dry location, away from uncured concrete, cememt or masonry products, acids, oxidizers, rain water, or any other chemical or substance that might damage the stair material or finish.

D. Exercise particular care to avoid damage to material finishes or unprotected surfaces when handli

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. **Basis of Design Specification:** Lapeyre Stair, Inc; www.lapeyrestair.com/#sle.

B. FS Industries; www.fsindustries.com

C. Cutting Edge Steel; www.cesteel.com

D. Stairs meeting performance requirements and minimum sizes below would be considered if shop fabricated and designed by Professional Structural Engineer licensed in the State in which the Project is located.

E. Substitutions: See Section 01 60 00.

2.02 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft (4.7 kPa) and a concentrated load of 300 lb (and a concentrated load of 14.4 kg) on an area of 4 square inches without exceeding the allowabale working stress of the material. Treads shall be designed to withstand all required design loads in accordance with the required codes of the applicable project.
      b. Stair Railings: Shall be capable of withstanding a single concentrated load of 200 pounds or a unifrom load of 50 pounds per linear foot applied in any direcction at any point on the rail without exceeding the design working stress of the materials.
      c. Stair Stringers: Shall be capable of withstanding a uniform live loading of 100 pounds per square foot applied in a downward direction to all installed tread surfaces or a 300 pound load on an area of 4 sqaure inches without exceeding the allowable working stress of the material. Stair stringers shall also be designed to withstand all required design loads in accordance with the required codes of the applicable project.

d. Guard Railings: Shall be capable of withstanding a single concentrated load of 200 pounds or a uniform load of 50 pounds per linear foot applied in any direction at any point on the rail without exceeding the design working stress of the material.

4. Dimensions: As indicated on drawings.
5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
a. Welded Joints: Continuously welded and ground smooth and flush.
b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
c. Exposed Edges and Corners: Eased to small uniform radius.
d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
2. Industrial: All joints made neatly.
a. Welded Joints: Welded on back side wherever possible.
b. Welds Exposed to Touch: Ground smooth.
c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
4. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.
5. Concrete Reinforcement: Welded wire mesh.
6. Concrete Finish: For Rubber Floor Covering.

D. Risers: Same material and thickness as tread pans.
1. Risers must be a solid material.
2. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
3. Nosing Depth: Not more than 1-1/2 inch (38 mm) overhang.
4. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch (12 mm) wide.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

F. Railings: Steel pipe railings.

G. Finish: Shop- or factory-prime painted.

H. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.04 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Steel bar grating.
   1. Grating Type: Welded.
   2. Bearing Bar Depth: 3/4 inch (19 mm), minimum.
   3. Top Surface: Standard.
   4. Nosing: Checkered plate.
   5. Nosing Width: 1-1/4 inch (32 mm), minimum.
   6. Factory Fabricated Tread and Nosing: Manufacturer's standard, with integral tread, nosing, abrasive filler and factory applied finishes.
   7. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

E. Railings: Steel pipe railings.

F. Finish: Shop- or factory-prime painted.

2.05 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.

B. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.
   2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
      a. Outside Diameter: 1 inch (25 mm).
      b. Material: Steel pipe or tube, round.
      c. Vertical Spacing: Maximum 4 inches (100 mm) on center.
      d. Jointing: Welded and ground smooth and flush.
   3. End and Intermediate Posts: Same material and size as top rails.
      a. Horizontal Spacing: As indicated on drawings.
      b. Mounting: Welded to top surface of stringer.

C. At ADA & TAS complaint stairs, provide a 12" extension at the top and bottom of the handrail.

2.06 MATERIALS

A. Stringers:
   1. Guard Mounted: 1" x 2.75" x 12" x 2.75" x 11 gauage formed zee-section of carbon steel HRPO per ASTM A1011/A1011M
   2. Wall Mounted: 1" x 1.25" x 12" x 2.75" x 11 guage formed zee-section of carbon steel HRPO per ASTM A1011/A1011M

B. Stringer Mounting Flanges: Minimum 11 guage carbon steel HRPO per ASTM A1011/A1011M (50KSI minimum)

C. Cross Bracing Straps: Lengths of 1.0" width x .25" thick Hot Rolled Steel Flat Bar per ASTM A36/A36M

D. Back pans: Minimum 16 guage Carbon Steel HRPO per ASTM A1011/A1011M

E. Rails and Balusters: Min. 43 ksi yield strngth; Carbon Steel per ASTM A1011/A1011M; fully annealed tube per ASTM A500/A500M Grade B or ASTM A513/A513M Grade 1008 or higher as-welded tubing.

F. Rail Tabs: Nominal .1875" thick carbon steel HRPO per ASTM A1011/A1011M

G. Rail End Caps:
   1. Standard .75" spherical radius, finned, universal tube closure cap molded from low density polyethylene.
   2. Option: 0.75" spherical radius closure cap machined from UNS-G12144 or SAE/AISI 12L14 Carbon Steel per SAE J403 or equivalent cold drawn round per ASTM A108

H. Rail End Connectors: 1.5” Φ connector machined from UNS-G12144 or SAE/AISI 12L14 Carbon Steel per SAE J403 or equivalent cold drawn round per ASTM A108

I. Baluster Clamp Plate: Nominal .1875” thick 304L (UNS-S30403) Stainless Steel per ASTM A240/A240M

J. Baluster end spacers: 1” external Φ, 0.4375” internal Φ x 1” Long XXS type 304 (UNS-S30400) Stainless Steel Pipe per .ASTM A999/A999M.

K. Handrail Joiners: 5” x 1” x ¼” slotted flat bar w/ 3/8” x 1” set screws, AISI 304 SS.

L. Handrail brackets:
1. Wall mount: Wagner Companies Type B – 2-1/2” or equal
2. Baluster mount: 1-1/4” w x 2-3/4” L x 2-1/2” h x ¼” L-shape ASTM A1011

M. Tread, Landing, Stair rail, Cross Bracing, or Back Pan Fasteners:
1. Bolts: Hex Head SAE J429 Grade 5; ½” Φ x 13TPI or Carriage Head A307 as shown on the Installation Instructions
2. Nuts: ASTM A563/A563M Grade 0
3. Washers: ASTM F844

N. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.

O. Perforated Plate:
1. Perforation Pattern: Square hole, 1/8 inch by 1/8 inch (3.2 mm by 3.2 mm), straight pattern.
a. Meeting TAS & ADA Standards

P. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

Q. Concrete Fill: Portland cement Type I, 3000 psi (20 MPa) 28 day strength, 2 to 3 inch (51 to 76 mm) slump.

R. Concrete Reinforcement: Mesh type, galvanized.

2.07 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
2. Number of Coats: One.

D. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in concrete with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on shop drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 SCHEDULES

A. Control Operations Buidling Interior Stair: Concrete-filled pan treads and landings, with primed finish. Field painted finish.

B. All other stairs: Checkered plate treads and landings, with galvanized finish.

END OF SECTION 05 51 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonstructural dimension lumber framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Fire retardant treated wood materials.

D. Miscellaneous framing and sheathing.

E. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 062000 - Finish Capentry

B. Section 081113 - Hollow Metal Doors and Frames

1.03 REFERENCE STANDARDS

A. ANSI/AWC PWF - Permanent Wood Foundation Design Specification; 2021.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

E. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata (2026).

F. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2026.

G. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ITS (DIR) - Directory of Listed Products; Current Edition.

J. PS 2 - Performance Standard for Wood Structural Panels; 2019.

K. PS 20 - American Softwood Lumber Standard; 2025.

L. SPIB (GR) - Standard Grading Rules; 2021.

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit technical data on wood treatment.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with the following agencies:
   1. Lumber Grading Agency: Certified by ALSC.
   2. Plywood Grading Agency: Certified by APA.

B. Regulatory Requirements: Conform to applicable codes for fire-retardant treatment of wood surfaces for flame/smoke ratings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect wood materials for conformance to specified grades, species, and treatment at time of delivery to project site.

B. Reject and return unsatisfactory wood materials.

C. Provide facilities for handling and storage of materials to prevent damage to edges, ends and surfaces.

D. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

E. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry or MC15.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 60.
   3. Performance Category: 3/4 PERF CAT.

B. Wall Sheathing: PS 2 type.
   1. Bond Classification: Exterior.
   2. Grade: Structural I Sheathing.
   3. Span Rating: 24.
   4. Performance Category: 3/4 PERF CAT.
   5. Edge Profile: Square edge.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 FIRE-RETARDANT TREATMENT (FRT)

A. Products:
   1. Arxada: www.arxada.com/#sle.
   2. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
   3. Viance, LLC; D-Blaze: www.treatedwood.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

C. Fire-Retardant Treatment: Interior Type A, Use Category UCFA (HT), High Temperature.
   1. Treat blocking and other wood members concealed in noncombustible construction.
   2. Treat electrical and communications panel backer boards.
   3. Treat wood and plywood used in roof framing and attic spaces.

D. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.

E. Fabrication of FRT Wood:
   1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
   2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
   3. Field cutting and drilling of holes in plywood are permitted.

F. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

2.05 PRESSURE-PRESERVATIVE TREATMENT (PPT)

A. Manufacturers:
   1. Koppers Performance Chemicals, Inc: www.koppersperformancechemicals.com/#sle.
   2. Viance, LLC; Preserve ACQ: www.treatedwood.com/#sle.

B. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

C. Applications - Treat the Following:
   1. Lumber and plywood in permanent wood foundations: Use Category UC4B, ground contact, heavy duty.
   2. Wood wall sheathing in contact with exterior foundation walls where sheathing is less than 8 inches (200 mm) from exposed earth: Use Category UC3A, above ground, exterior, protected.

D. Kiln-dry wood after treatment with waterborne preservative to maximum moisture content of 19 percent for lumber and 15 percent for plywood.

E. Fabricate to maximum extent possible before treatment.

F. Label preservative-treated wood with marking as required by AWPA U1 and ICC (IBC). Unless otherwise permitted by standard U1 and building code, include the following markings: AWPA U1, accredited inspection agency mark, treating plant identification, type of preservative, preservative retention, and permitted end use.

G. Field Treatment for Cuts and Holes in Preservative-Treated Wood: Comply with AWPA M4.

2.06 ACCESSORIES

A. Metal and Finish of Fasteners:
   1. Fire-Retardant-Treated Wood:
      a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
      b. Fasteners other than staples, nails, timber rivets, wood screws, and lag screws: Mechanically deposited zinc-coated steel, ASTM B695 Class 55 or better.
   2. Preservative-Treated Wood:
      a. Fasteners in permanent wood foundations:
         1) Comply with ANSI/AWC PWF.
      b. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
         1) Exception: See fasteners for permanent wood foundation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work.
   1. Verify that spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailing strips.

B. Report in writing, to the Architect, conditions that will adversely affect satisfactory execution of the work of this section. Do not proceed with work until unsatisfactory conditions have been corrected.

C. By beginning work, the contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide nonstructural framing and blocking to support the following:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.

5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.
10. Other wall- or ceiling-mounted items indicated on drawings.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.07 SITE-APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

END OF SECTION 06 10 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Hardware.

C. Fire-retardant treatment (FRT).

D. Shop finishing.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry

B. Section 09 90 00 - Painting

1.03 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; Current Edition.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2026.

D. BHMA A156.9 - Cabinet Hardware; 2020.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Definitions
   1. Exposed portions of cabinets shall include all surfaces visible when doors are closed. All visible members in open cases shall be considered as exposed portions.
   2. Semi-exposed portions of cabinets shall include these members behind opaque doors, such as shelves, divisions, interior faces of ends, cabinet backs and bottoms.
   3. Concealed portions of cabinets shall include sleepers, web frames and other surfaces not usually visible after installation.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   2. Include certification program label.

D. Samples:
   1. Plastic laminate, 8" x 10" for each type, color pattern and surface finish.
   2. Exposed cabinet hardware, one unit of each type and finish.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; color as selected by Architect; textured, low gloss finish.
1. Products:
a. Formica Corp..
b. Nevamar Corp
c. Wilsonart Corp. - Premium Quality
d. Lamin-Art - Pearlescence Quality

B. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.03 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

C. Fasteners: Of size and type to suit application; finish in concealed locations and finish in exposed locations.

D. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch (38 mm) minimum.

E. Concealed Joint Fasteners: Threaded steel.

2.04 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Base & Wall Cabinets: Shelf Standards: Recessed style, satin finish; 255NP manufactured by Knape & Vogt.

C. Base & Wall Cabinets: Shelf Brackets: wood shelves style, Zinc Finish finish; 256R manufactured by Knape & Vogt.

D. Open Shelf Standards: surface mounted style, titanium finish; 82 manufactured by Knape & Vogt.

E. Base & Wall Cabinets: Shelf Brackets: wood shelves style, Zinc Finish finish; 182 manufactured by Knape & Vogt.

F. Hinges: Two (2) hinges per door under 30" in height and a maximum of 24" in width and 3/4" thick. Hinges shall be equal to "Grass 3903"

G. Drawer Guide - Capcity of 75 lbs; #1300 manufacturered by Knape & Vogt

H. Pulls: Haefele #117.64.436 or approved equal.

I. Catches: Stanley Magnetic Cabinet Catch No. 41, Finish US28, one per door or approved equal.

J. Drawer and Door Locks:
   1. Equal to "Timberline" Cam Lock CB-180 Series. Locations as indicated on drawings. If none are indicated, then bid on half of the cabinets and drawers receiving locks and request locations during submittals.

K. Grommets: Flush mounted rubber grommet - 2 inch in diameter
   1. For metal countertops flush mounted metal grommet. Equivalant to Hafele #631.31.012

L. Countertop Support Brackets: Hiden in wall, flush mount, heavy duty bracket (pre drywall installation).
   1. Material: Aluminum.
      a. Finish: Manufacturer's standard, factory-applied, powder coat.
      b. Color: Off White.
      c. Height: 18 inches (460 mm) overall.
      d. Model Number: EH-1818FM supports 25" in depth, EH-1824 FM supports counters 30" in depth.
   2. Products:
      a. A&M Hardware, Inc; Standard Brackets: www.aandmhardware.com/#sle.
      b. RAKKS.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

M. Countertop Brackets: Concealed vertical leg, side-of-stud mounting.
   1. Material: Steel plates.
      a. Finish: Manufacturer's standard, factory-applied powder coat.
      b. Color: Black.
      c. Counter top Depth of 24 inches or 30 inch depth counter top as indicated on drawings.
      d. Minimum weight rating of 300 lbs per bracket
      e. Install per manufacturer recommendations to solid wall support or blocking as directed by manufacturer. Space per manufacturer requirements.
      f. Assume install location will have wood blocking on each side of metal stud.
   2. Products:
      a. Rakks EH Inside Wall Mount.

2.05 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet material edges with matching veneer edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. Shop prepare and identify components for book match grain matching during site erection.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

2.06 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

D. Install prefinished paneling with full bed contact adhesive applied to substrate.

E. Install hardware in accordance with manufacturer's instructions.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION 06 20 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic panel walls assemblies.

1.02 REFERENCE STANDARDS

A. ASTM D 2843 - Smoke Density

B. ASTM D 635 - Flame Spread

C. ASTM D 1929- Self Ignition Temperature

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: For each panel and trim type.

C. Shop Drawings:
   1. For each wall paneling layout, indicate:
      a. Elevations: Dimensioned locations of panels and penetrations. Include field measurements indicating extents of paneling.

D. Samples: For each wall panel type, two samples, 6 inches by 6 inches (150 mm by 150 mm) in size, indicating specified color and texture.

E. Manufacturer's Instructions: For each panel type and associated trim, provide installation instructions.

F. Installer's qualification statement.

G. Maintenance Data: Panel maintenance and cleaning recommendations.

H. Executed warranty.

I. Specimen warranty.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 MOCK-UPS

A. Construct wall paneling mock-up indicating panels, trim, and joints.

B. Locate where directed.

C. Mock-up may remain as part of work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver products to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

C. Store products in clean, dry, interior areas in accordance with manufacturer's instructions.

D. Store plastic panels and trim flat.

1.07 FIELD CONDITIONS

A. Ambient Field-Cutting Conditions: Before field-cutting panels in temperatures below 40 degrees F (4.4 degrees C), warm space to 60 degrees F (16 degrees C) minimum. Maintain temperature for 24 hours before, during, and after field-cutting.

B. Ambient Conditions for Installation: When ambient temperatures are below 40 degrees F (4.4 degrees C), warm space to 60 degrees F (16 degrees C) minimum. Maintain temperature for 24 hours before, during, and after installation.

C. Ambient Conditions for Installation: When ambient temperatures are above 70 degrees F (21 degrees C), cool space to 60 degrees F (16 degrees C). Maintain temperature for 24 hours before, during, and after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Paneling:
   1. 3form: www.3-form.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PLASTIC PANEL WALL ASSEMBLIES

A. Description: Double-wall, hollow, rib-reinforced plastic panels; with tongue-and-groove edges for interlocking adjacent panels forming plastic panel wall assemblies.

END OF SECTION 06 64 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples: Submit two samples 2 by 2 inch (____x____ mm) in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Crane Composites, Inc: www.cranecomposites.com/#sle.
   2. Marlite, Inc: www.marlite.com/#sle.
   3. Nudo Products, Inc: www.nudo.com/#sle.
   4. Panolam Industries International, Inc: www.panolam.com/#sle.

2.02 PANEL SYSTEMS

A. Wall Panels FRP-1:
   1. Panel Size: 4 by 8 feet (1.2 by 2.4 m).
   2. Panel Thickness: 0.09 inch (2.3 mm).
   3. Surface Design: Pebbled.
   4. Color: As indicated on Interior Finish Legend..

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION 06 83 16

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cladding support systems, insulation penetrating.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing.

B. Section 06 10 00 - Rough Carpentry.

C. Section 07 21 00 - Thermal Insulation.

D. Section 07 27 26 - Fluid Applied Membrane Air Barrier

E. Section 07 42 13 - Metal Wall Panels.

F. Section 07 42 43 - Composite Wall Panels.

1.03 REFERENCE STANDARDS

A. ANSI/ACMA/PIC (CSP) - Code of Standard Practice, Industry Guidelines for Fabrication and Installation of Pultruded FRP Structures; 2011 (Reapproved 2012).

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate cladding support system manufacturer's requirements with requirements of exterior structural wall assemblies and cladding system.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's published descriptive data, including product attributes.
   1. Include data for cladding support system, wall fasteners, and wall anchors.

C. Shop Drawings: For each cladding support system; signed and sealed by Contractor-provided structural engineer; indicate:
   1. Elevations and Sections: Include column centers, elevations, and dimensions; indicate locations of system components, component spacings, and wall fasteners.

D. Delegated Design Documents: Submit for information, signed and sealed documents by structural engineer of record responsible for comprehensive design package of cladding system, including wall fasteners and anchors. Submit structural design, rail spacing, and calculations sufficient to comply with structural design criteria of this section.

E. Design Data: Submit for information, project-specific thermal performance values for above-grade walls; prepared by professional engineer; substantiate values based on alternative compliance methods described in ASHRAE Std 90.1 I-P and acceptable by AHJ.

F. Manufacturer Reports: Manufacturer's field representative installation inspection reports.

G. Designer's qualification statement.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Contractor's Design-Related Professional Design Services: Qualified professional structural engineer experienced in design of cladding support systems and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.

1.07 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct exterior wall assembly mock-up, including cladding support systems as indicated on drawings.

C. Locate as indicated on drawings.

D. Mock-up may not remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and elevated above grade.

B. Handle products without damaging; prevent bending, warping, and twisting to surfaces, edges, or corners.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 10-year manufacturer warranty against structural failure of cladding support system. Complete forms in Owner's name and register with manufacturer.

C. Installer Warranty: Provide 2-year warranty against installation defects commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Advanced Architectural Products, LLC; GreenGirt: www.smartcisystems.com/#sle.

B. Knight Wall Systems: www.knightwallsystems.com/#sle.

C. Strongwell; www.strongirt.com.

2.02 PERFORMANCE CRITERIA

A. Surface Burning Characteristics: Provide cladding support systems with a flame spread index (FSI) of 25 or less, and a smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84 or UL 723.

2.03 DESIGN CRITERIA

A. See Section 01 40 00 - Quality Requirements for additional information.

B. Structural Design Services: Provide Contractor's design-related professional services for structural design of cladding support systems based on the following criteria:
   1. Design Loads: Exterior wall design loads as indicated on structural drawings.
   2. Fastener Design Criteria: Minimum safety factor of three for both tension and shear values.
   3. Thermal Movement Design Criteria: Cladding systems allow for thermal movements without overstressing components and evidence of permanent component defects, based on maximum ambient temperature of 120 degrees F (49 degrees C).

2.04 CLADDING SUPPORT SYSTEMS, INSULATION PENETRATING

A. Z-Shaped, Thermally Improved Fiber-Reinforced Polymer (FRP) Girts With Steel Inserts:
   1. Description: Z-shaped, FRP girts with outboard and inboard faces; reinforced with integral, continuous, zinc-coated, steel sheet inserts.
   2. Rigid Foam Insulation Applications:
      a. Zinc-coated steel sheet splines to stabilize insulation panels.
   3. Steel Inserts and Splines: Zinc-coated steel sheets.

4. Girt Depth: As determined by Delegated Design
5. Orientation: As indicated on drawings.
6. Rail Spacing: In accordance with Contractor-provided structural design.

2.05 MATERIALS

A. Fiberglass Reinforced Polymer (FRP):
   1. Polyester resin matrix with recycled materials and fire-retardant additives; reinforced with glass strand rovings for longitudinal strength and continuous strand glass mats or stitched reinforcements for transverse strength.

2.06 FABRICATION

A. Shop fabricate to greatest extent possible.

2.07 ACCESSORIES

A. Miscellaneous Nonstructural Accessories: Provide nonstructural accessories; flashings, sealants, tapes, and shims as recommended by manufacturer, suitable for project-specific applications, and compatible with system components.

B. Wall Fasteners:
   1. Manufacturer's corrosion-resistant-coated steel wall fasteners for attaching cladding support systems to steel-framed structural wall assemblies.
      a. Structural Performance: Manufacturer's wall fasteners; type, spacing, and embedment in accordance with Contractor-provided structural design of cladding system.
      b. Thermal Performance: Manufacturer's wall fasteners with thermally isolated polymer washers.
   2. Cold-Formed Steel Substrates: Manufacturer's recommended self-tapping metal screws.

C. U-Shaped Window Perimeter Support:
   1. Description: U-shaped rail composed of composite metal and extruded plastic; rails penetrate insulation.
   2. Attachments to Substrate: Manufacturer's recommended fasteners attach rails to steel-framed exterior wall assemblies.
   3. Applications: Cladding and insulation support system for perimeters of windows and other openings.

D. FRP-Steel Attachments: Comply with ANSI/ACMA/PIC (CSP).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify substrates comply with contract documents, including specified tolerances, and are ready to receive work of this section.
   2. Verify air barrier, wall flashing, and rigid insulation work comply with contract documents.

B. Do not commence installation until noncompliant conditions have been corrected.

3.02 INSTALLATION

A. Install cladding support systems in accordance with Contractor-provided structural design and manufacturer's written instructions.

B. Installation of Wall Fasteners in Cold-Formed Metal Framing Wall Substrates: Install fasteners in accordance with Contractor-provided structural design.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Manufacturer Services: Provide services of manufacturer's field representative to inspect installation of cladding support systems.and provide written acceptance from manufacture

3.04 PROTECTION

A. Protect installed cladding support systems from subsequent construction operations.

END OF SECTION 07 05 43

PART 2 PRODUCTS

1.01 MATERIALS

A. Bentonite: Pure bentonite clay, granulated, dry, and comprised of at least 50 percent sodium montmorillonite; with at least 90 percent passing No.20 (850 micro m) mesh sieve, and maximum of 10 percent passing No.200 (75 micro m) mesh sieve.

END OF SECTION 07 17 16

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior and interior, masonry and stone surfaces.

1.02 RELATED REQUIREMENTS

A. Section 040500 - Mortar and Grout

B. Section 042613 - Masonry Veneer

C. Section 047200 - Cast Stone

1.03 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026a.

B. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

C. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.

D. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2022).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.

C. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience

1.06 MOCK-UPS

A. Prepare representative surface ___ by ___ inches (___ by ___ m) in size using specified materials and preparation and application methods on surfaces to be coated; approved mock-up constitutes standard for workmanship.

B. Locate where directed.

1.07 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F (10 degrees C) or higher than 100 degrees F (38 degrees C).

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty.
   1. Include coverage for degradation of waterproofing ability and reduction in graffiti resistance on designated substrate.

C. Submit Completed manufacturers written "Request for Warranty Form" to manufacturer ten (10) days prior to application.

D. After substanial completion of the project, submit manufacturers written "5-Year Warranty Application" to manufacturer for processing. Upon receiving validated warranty, submit copies to Architect and Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. PROSOCO, Inc. : www.prosoco.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two, _____ as recommended by manufacturer.
   3. VOC Content: Less than 30 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
   4. Moisture Absorption When Applied to Masonry: Five percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
   5. Moisture Absorption When Applied to Concrete: Five percent, maximum, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
   6. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.

2.03 PRODUCT SCHEDULE

Substrate	Type	Water Repellent
Brick / Concrete	Clay / Concrete	Weatherseal Siloxane PD
CMU	Split Face	Weather Seal Blok-Guard & Graffiti Control
CMU	Interior Burnished/Ground Face	Sure Klean Burnished Block Sealer
Stone Construction	Natural Stone	Weather Seal Nature Stone Treatment
Stone Construction	Manufactured Stone	Weather Seal Soloxane PD
Burnished Block	Exterior	Weather Seal Blox-Guard & Graffiti Control
Burnished Block	Interior	Consolideck DuraSheen
Glazed CMU - Mortar Joints Only	Interior	Weather Seal Block Guard & Graffiti Control

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.

2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 30 days.

D. Remove loose particles and foreign matter.

E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

F. Scrub and rinse surfaces with water and let dry.

G. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

D. Provide manufacturer's field service representative to inspect preparation and application work continuously during entire application period to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION 07 19 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction and exterior wall behind _____ wall finish.

B. Batt insulation in exterior wall and ceiling construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 07 05 43 - Cladding Support Systems

B. Section 07 21 19 - Foamed-In-Place Insulation

C. Section 07 27 26 - Fluid-Applied Membrane Air Barriers: Separate air barrier materials.

D. Section 07 52 00 - Modified Bituminous Membrane Roofing: Installation requirements for board insulation over low slope roof deck.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

F. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2025.

G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 1 - Non-reinforced core foam.
         2) Compressive Strength: 25 psi (172 kPa), minimum or as required by cladding support system.
         3) Thermal Resistance, R-value (10): At 1-1/2 inch (38.1 mm) thick; 9.6 (1.59), minimum, at 75 degrees F (24 degrees C)per ASTM C518.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Comply with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

5. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
6. Board Thickness: 1.5 inch (37.5 mm).
7. Board Edges: Square.
8. Products:
    a. DuPont de Nemours, Inc; Thermax XARMOR (ci): building.dupont.com/#sle.
    b. Rmax Inc; ECOMAXci FR: www.rmax.com/#sle.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
    1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
    2. Formaldehyde Content: Zero.
    3. Facing: Unfaced.
    4. Products:
        a. CertainTeed Corporation: www.certainteed.com/#sle.
        b. Knauf Insulation; Performance+ EcoBatt Insulation: www.knaufinsulation.com/#sle.
        c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.owenscorning.com/en-us/#sle.

B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
    1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
    2. Products:
        a. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
        b. ROCKWOOL; AFB: www.rockwool.com/#sle.
        c. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.

2.03 ACCESSORIES

A. Flashing Tape: Special reinforced film with high performance adhesive.
    1. Application: Window and door opening flashing tape.
    2. Width: As required for application.

B. Insulation Fasteners: Preassembled fastener units consisting of sealing washer, screw, and gasketing tube.
    1. Length as required by manufacturer for thickness of insulation material and penetration of deck substrate.
    2. Thread and tip types as required for substrate material.
    3. Quantities and fastener patterns are recommended by manufacturer for permanently attaching insulation with a flush finish.
    4. Products:
        a. Stud Walls: TruFast Walls, a Division of Altenloh, Brinck & Co. US, Inc; Grip-Deck TubeSeal: www.trufastwalls.com/#sle.
        b. CMU Walls: TruFast Walls, a division of Altenloh, Brinck & Co. US, Inc; Plasti-Grip PMF Anchor: www.trufastwalls.com/#sle
        c. Tilt Wall: TruFast Walls, a division of Altenloh, Brinck & Co. US, Inc; Plasti-Grip PMF Plastic Masonry Fasteners: www.trufastwalls.com/#sle

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches (406 mm) on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches (102 mm) wide sealant tape; comply with ASTM E2357.

B. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Tape insulation board joints.

E. Allow Architect to observe complete insulation prior to covering.

3.03 BOARD INSTALLATION USING CLADDING AND CONTINUOUS INSULATION SUPPORTS

A. Install supports in accordance with manufacturer's installation instructions.

B. Install supports in compliance with system orientation, sizes, and locations as indicated on drawings and in accordance with approved shop drawings.

C. Install supports to fill in exterior wall spaces without gaps or voids in insulation.

D. Trim insulation neatly to fit spaces and provide a continuous thermal layer.

3.04 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall, roof, and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Provide batt insulation (fiberglass or mineral wool) above ceilings as indicated in Documents. Insulation shall be uninteruprted above rooms indicated and extended for 4 feet in each direction beyond permimeter walls or extend vertically to roof deck and seal walls where perimeter wall extends to deck.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

END OF SECTION 07 21 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior framed walls.
   2. On the underside of floor decks.

B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

F. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.

G. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers; 2022.

H. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

I. UL 1040 - Standard for Safety Fire Test of Insulated Wall Construction; Current Edition, Including All Revisions.

J. UL 1715 - Standard for Safety Fire Test of Interior Finish Material; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

B. Contractor to ensure compatibility between spray foam insulation and rigid insulation.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

D. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in manufacturer's original containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.

B. Material shall be stored in a safe manner and where the temperatures are in the limis specified by the material manufacutrer.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
      a. Fire Protection: Provide intumescent coating or 15-minute thermal barrier of 1/2 inch (12.7 mm) gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
   2. Thermal Resistance: R-value (RSI-value) of 6.3 (1.11), minimum, per 1-inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
   3. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
   4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
   5. Air Permeance: 0.02 cfm per square foot (0.1 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
   6. Closed Cell Content: At least 90 percent.
   7. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   8. Products:
      a. Huntsman Building Solutions; Icynene HFO MAX: www.huntsmanbuildingsolutions.com
   9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes. **Coating may be exluded if spray foam is completely enclosed by gypsum board.**
   1. Coating Type: Single component, water-based.
   2. Protected Insulation Type: Spray polyurethane foam (SPF).
   3. Application: Apply using airless sprayer.
   4. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   5. Color: Selected from manufacturer's standard colors..
   6. Products:
      a. International Fireproof Technology Inc; DC315 Intumescent Coating: www.painttoprotect.com/#sle.
      b. No-Burn, Inc; Plus ThB Intumescent Coating: www.noburn.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply to a minimum cured thickness and R-value as indicated on drawings.

D. Apply protective coating monolithically, without voids, to fully cover foam insulation, to achieve fire rating required.

E. Patch damaged areas.

F. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

END OF SECTION 07 21 19

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PART 2 PRODUCTS

1.01 EXTERIOR INSULATION AND FINISH SYSTEM

A. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.
   2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
   3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot (mJ/sq m).

B. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf (299 Pa) differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

C. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

D. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches (100 by 150 mm) in size.

E. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.

F. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.

G. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

H. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

I. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons (500 liters) of sand.

1.02 MATERIALS

END OF SECTION 07 24 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied membrane air barriers.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Exterior metal stud walls.

B. Section 07 05 43 - Cladding Support System

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing.

D. Section 07 92 00 - Joint Sealants: Sealants applied to adjacent work.

E. Section 07 21 00 - Insulation

1.03 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air-impermeable but water vapor permeable, both to amount as specified, with seams and joints sealed to adjacent surfaces.

1.04 REFERENCE STANDARDS

A. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016 (Reapproved 2024).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

F. ASTM D2369 - Standard Test Method for Volatile Content of Coatings; 2020.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

J. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015, with Editorial Revision (2020).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on membrane and accessory material types, technical and test data, and composition.

C. Manufacturer's qualification statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.07 MOCK-UPS

A. Coordinate construction of mock-up to allow for inspection by Architect and Owner's Representative before start of installation.

B. Locate as indicated on drawings.

C. Mock-up may not remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original packaging with seals unbroken and properly labeled.

B. Store materials in their original undamaged packaging within a clean, dry, and protected location at a temperature above freezing and less than 90 degrees F (32 degrees C).

C. Sequence deliveries to avoid delays and minimize on-site storage.

1.09 FIELD CONDITIONS

A. Maintain substrate temperature and humidity and other conditions affecting performance requirements as recommended by materials manufacturers before, during, and after installation.

B. Perform work only when existing and forecasted weather conditions are within the limits as established by material manufacturer.

C. Proceed with installation only when substrate construction and other preparation work are completed and in acceptable condition for air barrier material.

D. Do not apply to frozen substrate; allow adequate time for substrate to thaw, if freezing conditions exist before application.

E. Ultraviolet (UV) Exposure: Do not expose air barrier materials to sunlight and weather longer than recommended by material manufacturer.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Membrane Air Barriers:
   1. PROSOCO, Inc: www.prosoco.com/#sle.
      a. Location: Lawrence, KS.
      b. Phone: (800) 255-4255.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with physical and performance requirements as indicated:
   1. Provide building envelope with a continuous air- and water-resistive barrier that controls air leakage, avoids condensation in interior wall assembly, and prevents water intrusion.
   2. Provide watertight and airtight joints; seal penetrations and paths of water and air infiltration.
   3. Provide system that withstands positive and negative combined wind, stack effect, and static pressure in HVAC on building envelope without damage or displacement.
   4. Provide system that is airtight and flexible, allowing for relative movement of systems due to thermal and moisture variations.

2.03 FLUID-APPLIED MEMBRANE AIR BARRIERS

A. Applications:

B. Vapor-Permeable Membrane Air Barrier, Fluid Applied: Prevents air and water leakage in cavity wall, masonry veneer construction, stucco, exterior insulation and finish systems (EIFS), and most other above-grade wall assemblies complying with ICC-ES AC212.

1. Material: Limestone, water, and acrylic polymer.
2. Air Permeance: 0.004 cfm/sf (0.02 L/(s sq m)) maximum leakage when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E2178.
3. Water Vapor Transmission Rate: At least 25 perms (1425 ng/(Pa s sq m)) at 10 mil, 0.010-inch (0.254 mm) thickness, when tested in accordance with ASTM E96/E96M using Water Method, at 73.4 degrees F (23 degrees C).
4. Tensile Bond: 15 psi (103.4 kPa), minimum, when tested in accordance with ASTM C297/C297M.
5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke-developed index of 450 or less, Class A when tested in accordance with ASTM E84.
6. Fastener Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
7. Products:
    a. PROSOCO, Inc; R-GUARD Spray Wrap MVP (Most Vapor Permeable): www.prosoco.com/#sle.

2.04 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Thinners and Cleaners: As recommended by material manufacturer.

C. Metal Flashing: See Section 07 62 00.

D. Primer for Gypsum Wallboard Edges: Brush-on, breathable liquid primer with glue-like viscosity; used to seal cut edges of gypsum wallboard where exposed in rough openings for windows and doors; sealed edge provides compatible surface for application of liquid-applied, fiber-reinforced fill coat and seam treatment for through-wall components.
1. Color: Light blue.
2. Total Solids: 16 percent, in accordance with ASTM D2369 test method.
3. VOC Content: Less than 13.3 fl oz/gal (100 g/L).
4. Products:
    a. PROSOCO, Inc; R-GUARD PorousPrep: www.prosoco.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Joint and Seam Filler: Silyl-terminated polymer (STP); single-component, fiber-reinforced gun-grade adhesive and detailing compound with silicone and polyurethane properties.
1. Color: Pale red.
2. Water Vapor Transmission Rate: At least 19 perms (1083 ng/(Pa s sq m)) at 20 mil, 0.020-inch (0.508 mm) thickness, when tested in accordance with ASTM E96/E96M.
3. Tensile Strength: 70 psi (483 kPa), minimum, when tested in accordance with ASTM D412.
4. Elongation at Break: Greater than 180 percent when tested in accordance with ASTM D412.
5. Total Solids: 99 percent.
6. VOC Content: Less than 4 fl oz/gal (30 g/L).
7. Products:
    a. PROSOCO, Inc: www.prosoco.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Liquid-Applied Flashing: Single-component silyl-terminated polymer (STP) waterproofing, adhesive, and detailing compound with silicone and polyurethane properties which produces durable, seamless elastomeric membrane to flash rough openings of structural walls, to counterflash waterproofing and air barrier components, and to treat joints, seams, and cracks.
1. Application: Gun-grade, spread-and-tool, or roller-applied.
2. Color: Red.
3. Water Vapor Transmission Rate: At least 21 perms (1197 ng/(Pa s sq m)) when tested in accordance with ASTM E96/E96M.

4. Tensile Strength: 150 psi (1034 kPa), minimum, when tested in accordance with ASTM D412.
5. Elongation at Break: Greater than 350 percent, when tested in accordance with ASTM D412.
6. Total Solids: 99 percent.
7. VOC Content: Less than 4 fl oz/gal (30 g/L).
8. Products:
    a. PROSOCO, Inc; R-GUARD FastFlash: www.prosoco.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Waterproofing Sealant: Single-component, gun-grade, waterproofing sealant that has silicone and polyurethane properties; silyl-terminated polymer (STP) produces durable seals, and stops movement of moist air through cracks surrounding windows and doors.
1. Color: White paste.
2. Tensile Strength: 85 psi (300 kPa), minimum, when tested in accordance with ASTM D412.
3. Elongation at Break: Greater than 1,000 percent, when tested in accordance with ASTM D412.
4. Peel Strength: 25 pli (4.4 kN/m) when tested in accordance with ASTM C794.
5. Total Solids: 98 percent.
6. VOC Content: Less than 4 fl oz/gal (30 g/L).
7. Products:
    a. PROSOCO, Inc; R-GUARD AirDam: www.prosoco.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

H. Backer Rod: Closed-cell, suitable for deep joints.

I. Preformed Silicone Sealant Extrusion: Extruded, elastomeric, precured silicone material that provides a continuous transition and bridges windows and door frames at curtain wall, storefront, expansion joints, skylights, and roof to air barrier materials.
1. Tensile Strength: 700 psi (4826 kPa), minimum, when tested in accordance with ASTM D412.
2. Shore Hardness, Type A: 50 to 65 when tested in accordance with ASTM D2240.
3. Elongation at Break: Greater than 400 percent, when tested in accordance with ASTM D412.
4. Joint Movement Capacity: Greater than 200 percent elongation and 75 percent compression.
5. Ultraviolet (UV) Resistance: No degradation of material when exposed to UV.
6. Products:
    a. PROSOCO, Inc; R-GUARD SureSpan EX: www.prosoco.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

J. Silicone Sealant Extrusion Adhesive: Single-component, gun-grade adhesive that has silicone and polyurethane properties; silyl-terminated polymer (STP) is easy to gun, spread, and tool.
1. Color: Gray.
2. Tensile Strength: 150 psi (1034 kPa), minimum, when tested in accordance with ASTM D412.
3. Shore Hardness, Type A: 40 to 50 when tested in accordance with ASTM D2240.
4. Elongation at Break: Greater than 200 percent, when tested in accordance with ASTM D412.
5. Total Solids: 99 percent.
6. VOC Content: Less than 4 fl oz/gal (30 g/L).
7. Products:
    a. PROSOCO, Inc; R-GUARD SureSpan Adhesive: www.prosoco.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for work in this section.

B. Verify surfaces are sound, clean and free of voids, surface oxidation, dirt, loose aggregate, sharp protrusions, excess mortar, or other contaminants such as grease, oil, and wax that are detrimental to application.

C. Where existing conditions are the responsibility of another installer, notify Architect of unsatisfactory conditions.

D. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surface to receive adhesives and sealants in accordance with manufacturer's installation instructions.

C. Treat joints in substrate and between dissimilar materials in accordance with manufacturer's installation instructions.

D. Fill or bridge damaged surfaces, voids, or gaps larger than 1 inch (25.4 mm).

E. Fill voids and gaps measuring 1 inch (25.4 mm) or less with liquid-applied fill coat and seam filler as necessary to ensure continuity.

F. Exterior Sheathing:
   1. Ensure that sheathing is properly installed with ends, corners, and edges properly fastened; remove and replace damaged sheathing.
   2. Set mechanical fasteners flush with sheathing; spot overdriven fasteners with liquid-applied fill coat and seam filler.
   3. Seal cut edges of gypsum wallboards exposed in rough openings for windows and doors at corners, as recommended by manufacturer.
   4. Where exterior masonry veneer is being installed, install masonry anchors before installing air barrier over masonry; provide airtight seal around anchors.

G. Masonry and Concrete Substrates:
   1. Ensure that masonry head and bed joints are filled and tooled.
   2. Mechanically remove loose mortar fins, mortar accumulations and protrusions, and debris.
   3. Fill cracks, joints, and gaps with liquid-applied fill coat and seam filler.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with seams and joints sealed to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Backer Rod: Control sealant depth by installing closed-cell backer rod, with diameter 25 percent greater than joint width; do not puncture backer rod.

E. Fluid-Applied Membranes:
   1. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch (6 mm) along coating seams, rough cuts, and as recommended by manufacturer.
   2. Use flashing to seal adjacent construction and to bridge joints in coating substrate.
   3. Apply liquid-applied fill coat and filler for seams, joints, cracks, gaps, primed rough edges at gypsum sheathing, and rough openings in accordance with manufacturer’s written instructions.

4. Rate of Application: Spray apply air barrier to substrate at ratings recommended by manufacturer to provide pinhole-free surface and uniform color.
5. Cap and seal top edge of fluid-applied air barrier where it comes in contact with roofing system to eliminate water intrusion.

F. Openings and Penetrations in Exterior Air Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. Apply liquid flashing membrane over surfaces to seal and waterproof rough openings in accordance with manufacturer's written instructions.
   a. Spread wet product to create an opaque, monolithic flashing membrane that surrounds the rough opening and extends 4 to 6 inches (102 to 152 mm) over face of structural wall or sheathing. Apply additional coats as necessary to provide a void-free and pinhole-free surface.
3. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
4. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide and covering entire depth of framing.
5. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air barrier to flashing.
6. At interior face of openings, seal gap between window and/or door frame, and rough framing, using joint sealant over backer rod.
7. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Obtain approval of installation procedures from air barrier manufacturer based on installed-in-place mock-up before proceeding with remainder of installation.

C. **Manufacturer's Field Services:** Provide the services of a manufacturer's authorized field representative to verify specified products are used, and protection, surface preparation, and installation are in accordance with the manufacturer's written instructions and the mock-ups approved by the Architect. Submit manufacturer written reports of field visit to Architect prior to beginning masonry veneer installation or covering installation. If membrane is applied in different areas of the building or project at different times separated by more than one week there shall be separate manufacture reports for each application.

3.05 PROTECTION

A. Do not leave installed materials exposed to sunlight and weather longer than recommended by manufacturer.

END OF SECTION 07 27 26

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal roof panel system of preformed steel panels.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

D. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2024.

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

G. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

H. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2024).

I. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).

J. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include structural analysis signed and sealed by qualified structural engineer, indicating compliance of roofing system to specified loading conditions.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.
   1. Include typical panel joint in sample.
   2. Include typical fastening detail.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least fifteen years of documented experience.

B. Manufacturer shall provide a minimum of 3 roof inspections during installation of each roof and submit field report of each inspection. Inspection shall validate installation of roof in compliance with the manufacturer's details and recommendations.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.06 MOCK-UPS

A. Provide mock-up of ___ sq ft (___ sq m), including underlayment, shingles, eave protection membrane, and associated flashings.

B. Locate as indicated on drawings.

C. Mock-up may not remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor. The manufacturer shall have the sole and exclusive obligation for all warranty work commencing on the date of substantial completion.

C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Metal Roof Panel Manufacturers:
   1. Elevate: www.holcimelevate.com/#sle.
   2. MBCI, a Cornerstone Building Brands Company: www.mbci.com/#sle.
   3. Petersen Aluminum Corporation; Tite-Loc Panel: www.pac-clad.com/#sle.

B. Metal Soffit Panels Manufacturers:
   1. Elevate: www.holcimelevate.com/#sle.
   2. MBCI, a Cornerstone Building Brands Company: www.mbci.com/#sle.
   3. Petersen Aluminum Corporation; PAC-750 Soffit: www.pac-clad.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
      a. Dead Loads: Weight of roofing system.
      b. Live Loads: As required by ASCE 7.

2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
4. Air Infiltration: Maximum 0.06 cfm/sq ft (1.1 cu m/hr/sq m) at air pressure differential of 6.24 lbf/sq ft (300 Pa), when tested according to ASTM E1680.
5. Water Penetration: No water penetration when tested in accordance with procedures and recommended test pressures of ASTM E1646; perform test immediately following air infiltration test.
6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).
7. Thermal Resistance: Provide throughout system, R-value (RSI-value) of 24 (4.22) at 3 inch (76 mm) thick, minimum, when tested in accordance with ASTM C1363.

2.03 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Zinc-coated steel complying with ASTM A653/A653M; minimum G90 (Z275) galvanizing.
      b. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
   2. Profile: Standing seam, with minimum 2-inch (51 mm) seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth.
   4. Length: Full length of roof slope, without lapped horizontal joints.
   5. Width: Maximum panel coverage of 16 inches (406 mm).

C. Metal Soffit Panels:
   1. Profile: _____, with venting provided.
   2. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness.
   3. Color: As indicated on drawings.

2.04 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.05 FABRICATION

A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.06 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as indicated on drawings.

2.07 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness,

and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
   3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Thermal Insulation: Provide rigid type, faced with white, flexible, non-dusting vapor retarder tested for maximum flame spread index of 50, per ASTM E84; for installation using spacer blocks.
   1. Thermal Resistance: Minimum, R-value of 25 (RSI of 4.4).

E. Underlayment: Self-adhering polymer modified asphalt sheet complying with ASTM D1970/D1970M, with strippable release film and top surface of woven polypropylene sheet.
   1. Sheet Thickness: 40 mils, 0.040 inch (1.02 mm), minimum.
   2. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
   3. Products:
      a. Grace Ultra
      b. Carlisle WIP300HT.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

E. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

F. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.
   2. Provide sealant tape or other approved joint sealer at lapped panel joints.
   3. Install sealant or sealant tape at end laps and side joints as recommended by metal roof panel manufacturer.

D. Insulation: Install insulation between roof covering and supporting members to present a neat appearance; fold, staple, and tape seams unless otherwise approved by Architect.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 07 41 13

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, soffit panels, and subgirt framing assembly, with related flashings and accessory components.

B. Refer to Section 13 34 19 for Metal Wall Panels and Metal Roof Panels for Pre-Engineered Metal Structures.

C. Metal panels addressed in this specification applies to the Admin and Operations building or as scheduled in the drawings.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing.

B. Section 05 50 00 - Miscellaneous Metals.

C. Section 07 05 43 - Cladding Support Systems.

D. Section 07 21 00 - Thermal Insulation.

E. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.

F. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 508 - Voluntary Test Method and Specification for Pressure Equalized Rainscreen Wall Cladding Systems; 2021.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

1.04 SUBMITTALS

A. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

C. Samples: Submit one samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate panel assemblies with rain drainage, flashing, trim, stud back-up, soffits, and other adjoining work.

B. Pre-installation Meeting.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.07 MOCK-UPS

A. Construct mock-up as indicated on drawings; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, and related insulation in mock-up.

B. Locate As coordinated between Contractor and Architect.

C. Mock-up may not remain as part of work.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents within mockups unless these deviations are approved by the Architect in writing.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

D. Do not stack panels horizontally, store wall panels vertically.

1.09 FIELD CONDITIONS

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

B. Coordination of Trades: Contractor shall coordinate all trades that interface with the metal wall panels to ensure locations of structural elements, windows, louvers, doors, and other elements are installed per the contract drawings and within tolerance prior to field measurements.

C. Field Measurements: Contractor shall verify locations of structural members and wall opening dimensions by field measurements
   1. Contractor and Installer to coordinate with construction schedule.
   2. Record field measurements on Submittal Drawings and submit to panel manufacturer before panel fabrication.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.
   1. Warranty Coverage: In accordance with AAMA 2605 for 70 percent PVDF resin on aluminum finish requirements.

C. Wall System Warranty: Provide 2-year warranty, agreeing to correct defects in manufacturing of materials from the date of Substantial Completion. Complete forms in Owner's name and register with warrantor.
   1. Failures include, but not limited to, structural failures, including rupturing and cracking of the base metal.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Wall Panels - Concealed Fasteners:
   1. **Basis of Design:** Centria, a Nucor Company; Intercept+ Entyre Modular Metal Panels: www.centria.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
   3. Note if an alternate product is requested for substitution, the contractor and manufacturer will be responsible for all changes necessary as a result of the request, including but not limited to dimensions, sizes, cladding support system modifications, etc.

2.02 METAL WALL PANEL SYSTEM

A. Description: Factory-fabricated, pressure-equalized rainscreen (PERS) panel system, site assembled; comply with AAMA 508.

B. Exterior Wall Panels:
   1. Metal: Aluminum Alloy 3003-H-14 of equal
      a. Nominal Thickness: 0.063 inch
   2. Panel Depth: 1 3/8 inches nominal
   3. Panel Joints: 3/4 inches
   4. Panel Module Size: As indicated on drawings.
   5. Maximum Panel Length: 144 inches
   6. Weight: Approximately 1.0 psf
   7. Color: As indicated on drawings.

2.03 MATERIALS

A. Precoated Aluminum Sheet: ASTM B209/B209M, 3003 alloy, H14 temper, with smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating.

2.04 FINISHES

A. Fluoropolymer Coating System: Polyvinylidene fluoride (PVDF) two-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin,; color and gloss as indicated on drawings.

2.05 ACCESSORIES

A. Metal Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fascia, mullions, sills, corner units, flashings, and related items. Match material and finish of panels unless otherwise indicated.

B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized or as recommended by manufacturer.

C. Sub-Girts: Galvanized, provide size and age in accordance with project requirements.
   1. Furring Channel: Provide Hat, C, U or Z type as recommended by manufacturer.
   2. Flat Strap: At least 14 gauge thick.
   3. Refer to Section 07 05 43 for coordination with Cladding Support System.

2.06 FABRICATION

A. Fabricate wall panels within manufacturer's facilities and fulfill indicated performance requirements.
   1. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide aluminum wall panel with "cap-over" folds at corners where the panel is bent to form reveals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, and Work areas and conditions with Installer present for compliance with requirements for installation tolerances, wall panel supports, and other conditions affecting performance of this work.

B. Examine wall framing to verify that girts, angles, channels, studs, and other structural wall panel support members and anchorage have been installed as indicated on approved shop drawings and are within tolerances acceptable to metal wall panel manufacturer.
   1. 1/4 inch in 20 feet vertically or horizontally from face plane of framing.
   2. 1/2 inch maximum deviation from flat substrate on any building elevation.
   3. 1/8 inch in 5 feet.

C. Verify that weather barrier has been installed over insulation to prevent air infiltration or water penetration.

D. Examine rough-in for components and systems penetrating wall panels to coordinate actual penetration locations relative to wall panel joint locations prior to installation.

E. Proceed with wall panel production and installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Support for Cladding and Continuous Insulation: Install in accordance with Contractor-provided structural design; securely fasten; shim and level to uniform plane.
   1. Reference Section: 07 05 43 - Cladding Support System.

B. Install wall panels in accordance with manufacturer's submittal drawings and installation instructions.
   1. Wall panels consist of single sheets of metal formed with interlocking joinery and drainage system integral/joined to the panel with single horizontal attachment for dry-joint rainscreen assembly. Vertical attachment methods shall depend on panel orientation, size, and performance requirements.
   2. Allow for secondary drainage flashing, brackets, joint sealants or gaskets to manage the drainage of wall when called for by the manufacturer’s approved drawings
   3. J channels may be incorporated for perimeter terminations when shown on the approved drawings.
   4. Attach wall panels using progressive interlocking method, engaging bottom of panel in top of previous panel working bottom up and left to right unless directed otherwise by submittal drawings.
   5. Remove strippable protective covering from formed metal product immediately upon installation. Remove adhesive left from the protective cover by wiping clean as recommended by manufacturer.

C. Install wall panels for orientation, sizes, and locations as indicated on Drawings.

D. Install wall panels with proper anchorage and other components for this Work securely in place as recommended by manufacturer.

E. Install wall panels with provisions for thermal and structural movement.

F. Install shims up to 1/2” to plumb substrates as necessary for installation of wall panels.

G. Install weather tight escutcheons for pipe and conduit penetrating exterior walls.
   1. Use of sealants, gaskets, butyl tape at penetrations as detailed in the final approved submittal drawings is allowed.

H. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by wall panel manufacturer.

I. Install attachment system to support wall panels and with provisions to provide a complete weather tight wall system, including sub girts, extrusions, flashings and trim.
   1. Include attachment to supports and trims at locations using dissimilar materials.
   2. Do not apply sealants to joints, unless noted otherwise on Drawings or Shop Drawings.
   3. Install starter at wall base and areas where cut panels are indicated on Shop Drawings.

J. Install accessories with positive anchorage to building and weather tight mounting and provisions for thermal expansion, and coordinate installation with flashings and other components.
   1. Install components required for a complete wall panel assembly including trim, copings, flashings and other accessory items.

3.03 TOLERANCES

A. Shim and align wall panel units with installed tolerances of 1/4 inch in 20 feet, non-cumulative, on level, plumb, and location lines as indicated.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to assist with the initial wall panel installation to include accessories and inspect completed metal wall panel installation.
   1. Provide service on the mockup and on the initial 300 SF of actual work for each building if not built congruent.
   2. Provide written field report within ten (10) working days of the last day of site work.

B. Installer shall remove and replace metal wall panels where inspections indicate that they do not comply with specified requirements.

C. Installer shall prepare and submit progress reports weekly to the Contractor and Manufacturer until completion. Include total panels installed, crew size, and areas covered.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.06 PROTECTION

A. Protect metal wall panels until completion of project.

B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION 07 42 13

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PART 2 PRODUCTS

END OF SECTION 07 5 2 17

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modified bituminous roofing membrane, conventional application.

B. Insulation, flat and tapered.

C. Cover boards.

D. Roofing cant strips and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking: Placement of acoustical insulation for deck flutes.

B. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings, reglets and _____.

D. Section 07 72 00 - Roof Accessories

1.03 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

B. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board; 2017a (Reapproved 2022).

C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

E. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2016 (Reapproved 2022).

F. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).

G. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2016a (Reapproved 2023).

H. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a (Reapproved 2021).

I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

J. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).

K. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements; 2021.

L. CAN-ULC-S770 - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams; 2020 Reaffirmed.

M. FM (AG) - FM Approval Guide; Current Edition.

N. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.

O. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated flashings and counterflashings installed by other sections.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, and surfacing.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Field Reports: Indicate procedures followed and supplementary instructions given.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, and approved by manufacturer.

C. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by written certification on manufacturer's letterhead and presented for the specifier's consideration.

D. Manufacturer shall provide a minimum of 3 roof inspections during installation of each roof and submit field report of each inspection. Inspection shall validate installation of roof in compliance with manufacturer’s details and recommendations.

E. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the architect seventy-two (72) hours prior to the manufacturer's final inspection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide 30 -year No Dollar Limit (NDL) Roof Guarantee, covering both labor and material with no dollar limitation. Guarantee coverage shall include roof insulation, cover board, insulation fasteners as well as roofing membrane and bituminous flashings. Roof penetrations constructed with specified sealant shall also be covered by warranty (pitch pans are not allowed).

C. Provide a 3-year weathertightness warranty against all leaks.

D. Pro-rated Warranties shall not be accepted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Modified Bituminous Membrane Roofing:
   1. **Basis of Design** Johns Manville: www.jm.com/#sle.
      a. Contact: Robert Kadela (415) 200-6726; Rob.Kadela@jm.com
   2. US Ply, Inc; Conforming to these specifications..

B. High Wall Sheet Flashing Membrane (As indicated on drawings)
   1. **Basis of Design:** Johns Manville. www.jm.com
      a. JM TPO: 60 mils, internally or scrim reinforced
      b. Adhesive: JM Membrane Bonding Adhesive (TPO)
   2. UsPly, Inc; Conforming to these specifications.

2.02 MEMBRANE AND SHEET MATERIALS

A. Cap Sheet: Polymer modified asphalt, reinforced with nonwoven fabric; granule surfaced; with the following characteristics:
   1. Minimum Quality: ASTM D6163/D6163M Type I, Grade G; styrene-butadiene-styrene (SBS) modified, glass fiber reinforced.
   2. Solar Reflectance: 0.70, minimum, initial (ASTM C1549) , and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
   3. Color: White.
   4. Thickness: 165 mils (4.2 mm)
   5. Sheet Width: 39 3/8 inch (1000 mm).
   6. Products:
      a. Johns Manville; DynaGlas FR CR G: www.jm.com/#sle..

B. Base Sheet:
   1. Minimum Quality: ASTM D6163/D6163M, Grade S Type I; styrene-butadiene-styrene (SBS) modified, glass fiber reinforced.
   2. Products:
      a. Johns Manville; DynaWeld Base: www.jm.com/#sle..

C. Backer Sheet: ASTM D4601/D4601M Type II, Asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
   1. Product: Johns Manville; PermaPly 28: www.jm.com/#sle.

D. Backer Sheet: ASTM D6163/D6163M Grade S, Type I, glass fiber reinforced; smooth sufaced; suitable for application method specified.
   1. Product: Johns Manville; DynaWeld Base: www.jm.com/#sle

E. Flashing Sheet: ASTM D6163/D6163M Grade G, Type I, glass fibe
   1. Product: Johns Manville; DynaWeld Cap FR CR G: www.jm.com/#sle

F. Ply Sheet: ASTM D2178/D2178M; asphalt-coated glass fiber; Type IV.

G. Liquid Applied Flashing: A liquid and fabric reinforced flashing system created with a stitch bonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator.
   1. Product: Johns Manville; PermaFlash System: www.jm.com/#sle.

2.03 BITUMINOUS MATERIALS

A. Bitumen: Asphalt, ASTM D312/D312M Type IV; for adhering insulation, use Type III.

B. Asphalt Primer: ASTM D41/D41M, asphalt type.
   1. Basis of Design: JM Asphalt Primer

C. Asphalt Roof Cement: ASTM D4586/D4586M, Type II, asbestos-free.
   1. Basis of Deisgn MBR Utility Cement

2.04 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels; comply with ASTM C1177/C1177M.
   1. Thickness: 1/2 inch (12.7 mm), fire-resistant.
   2. Products:
      a. Georgia-Pacific; DensDeck Prime Roof Boards with EONIC Technology: www.densdeck.com/#sle.

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam complying with ASTM C1289.
   1. Classifications:
      a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
         1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
   2. Board Size: 48 by 96 inches (1,220 by 2,440 mm).
   3. Board Thickness: 1.5 inches (37.5 mm).
   4. Board Edges: Square.
   5. Insulation Requirements:
      a. Provide insulation package with a minimum R-Value of 25.2
      b. Provide insulation package with minimum thickness: 4.4
      c. Provide insulation package in multiple layers.
      d. Minimum Long-Term Thermal Resistance (LTTR): 5.7 per inch
         1) Determined in accordance with CAN-ULC-S770
   6. Products:
      a. Johns Manville; ENRGY 3 - Flat and Tapered: www.jm.com/#sle.

2.06 SURFACING MATERIALS

A. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Mineral-granule-surfaced, reinforced modified asphalt composition.
   2. Size: 32 by 32 inches (914 by 914 mm).
   3. Surface Color: White.
   4. Products:
      a. Johns Manville; DynaTred Walkway: www.jm.com/#sle.

2.07 EDGE METAL COMPONENTS

A. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

B. Roof Edge Drainage Systems: Gutter Systems: Manufactured in section lengths not exceeding 12 feet with 0.100-inch mill aluminum internal Gutter Hangers, 24 inches on center, and 2-inch-wide formed external wind straps 6’-0” on center

2.08 ACCESSORIES

A. Insulated Cant Strips: Perlite board, compatible with roofing materials; ASTM C728 ; cants formed to 45 degree angle.
   1. Basis of Design: FesCant Plus

B. Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
   2. Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM 4470 designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.
      a. Basis of Design: All purpose Fasteners and UltraFast Plate.

C. Urethane Adhesive: Manufacturer’s two component polyurethane adhesive formulated to adhere insulation to substrate. Basis of design: JM Two-Part Urethane Insulation Adhesive (UIA)

D. Provide saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
   1. Basis of Design: Tapered Fesco Edge Strip

E. Wood Nailer Strips: Comply with requirements in Division 06.

F. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - GENERAL

A. The minimum roof deck construction and deck surface preparation requirements which follow are provided as a supplementary guide for the roof deck designer and erector.

B. Acceptance of a roof deck by the manufacturer as satisfactory to receive roof materials only refers to the deck surface and slope.

C. Decks must be adequately smooth and level to provide support and maximum contact surface for roofing materials. The surface of the roof deck must be dry (free of moisture in any form), firm, smooth, clean, free of debris, sharp projections and depressions.

D. Remove electrical conduits, bolts, and other small items from the surface of the roof deck as these areas cannot be properly insulated and roofed.

E. All depressions, holes, deformations, etc. shall be made smooth prior to the roofing application.

F. All decks must be properly designed and constructed in accordance with the deck manufacturer's requirements and specifications, must be installed by applicators approved by deck manufacturer, must be able to support and secure the roof system, and must be properly related to the rest of the building.

G. Complete all openings or projections (all pipes, vents, ducts, stacks and openings, etc.) through the deck prior to roof system installation. No projections shall be constructed through the flashing cant and projections shall be located a minimum 18" (45.7 cm) from the intersection of the cant and roof deck.

H. Do not install electrical conduit or piping immediately above the roof deck. Roof systems cannot be properly installed and adhered around and/or over conduit.

I. All roof decks shall be designed and constructed:
   1. To support maximum loads which may be imposed during and after construction without excessive deflection (1/240 of the span at midspan is the rule for maximum allowable deflection);
   2. To provide a minimum ¼" (6 mm) per-foot slope and/or designed so that ponding water dissipates within a 48 hour period. Interior drains should be sumped below roof level to allow immediate water runoff.
   3. Provisions to prevent asphalt drippings must be given consideration where joints, cracks, or holes occur.
   4. On slopes 1/2inch per foot or greater, provisions must be made for insulation stops and/or back nailing of built-up felts. Insulation stops and/or backing nailing must be used on slopes greater than ½" (4 cm per meter) when SBS membranes are used;
   5. Deck materials must be fastened to supporting members by clips, welding or other mechanical devices to prevent lateral and vertical movement of the elements;
   6. To be consistent with applicable trade associations, as well as any code or insurance requirements.

J. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

K. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

L. If applicable, prime surface of deck with primer at a rate recommended by roofing manufacturer and allow primer to dry.

M. Proceed with each step of installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION - METAL DECK

A. Install preformed acoustical glass fiber insulation strips in roof deck flutes in accordance with manufacturer's instructions; see Section 05 31 00.

B. Rigid roof insulation boards and when applicable the base sheet must be uniformly secured to the steel deck with approved mechanical fasteners.

3.04 INSTALLATION - INSULATION

A. Attachment of Flat Insulation: Mechanically fasten top layer of insulation to deck in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
   1. Use fastener type and fastening pattern as required to achieve wind resistance specified.
   2. For supplemental perimeter and corner enhancements of fastener density at perimeters, add 50% more fasteners, but not less than 1 per 2 SF. At corners, add 100% more fasteners, but not less than 1 per 1 SF.

B. Attachment of Tapered Insulation: Adhered insulation to deck in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
   1. Install each layer in a two-part urethane adhesive according to roofing system manufacturer’s instruction.
   2. Install each layer to resist uplift pressure at corners, perimeter, and field of roof.

C. Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer’s written instructions. Fill gaps exceeding 1/4 inch (6 mm) with like material.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.

E. Do not kick insulation boards into place.

F. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. Do not apply more insulation than can be covered with membrane in same day. Insulation must not be left exposed to the weather.

I. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

3.05 INSTALLATION - COVER BOARD

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer’s written instructions. Fill gaps exceeding 1/4 inch (6 mm) with cover board.
   1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Adhered Cover Board: Adhere cover board to substrate as follows:
   1.
   2. Install to resist uplift pressure at corners, perimeter, and field of roof.

3.06 INSTALLATION - MEMBRANE

A. Install modified bituminous roofing membrane sheet, and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, with the following installation method:
   1. Unroll roofing membrane sheets and allow them to relax.
   2. Heat weld modified bituminous roofing membrane base and cap sheet to substrate according to roofing system manufacturer’s instruction.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
   1. Repair tears and voids in laps and lapped seams not completely sealed.
   2. As required, apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.

D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
   1.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Where roof slope exceeds 1/2 inch per 12 inches (1:24), contact the membrane manufacturer for installation instructions regarding installation direction and backnailing

F. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

G. Coordinate installation of roof drains and sumps and related flashings.

3.07 INSTALLATION - FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   2. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets.
   3. Backer Sheet Application: Heat Weld backer sheet to substrate as required by roofing system manufacturer.
   4. Flashing Sheet Application Heat weld flashing sheet to substrate as required by roofing system manufacturer.

B. Extend base flashing up walls or parapets 8 inches (200 mm) above roofing membrane. Refer to manufacturer's standard flashing details.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
   1. Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

D. Roof Drains: Flash drain using liquid applied flashing system. Clamp roofing membrane, flashing, and stripping into roof-drain clamping ring.
   1. Install stripping according to roofing system manufacturer's written instructions.

E. Flash all penetrations using liquid applied flashing system.

3.08 INSTALLATION - EDGE METAL

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements and SMACNA (ASMM) "Architectural Sheet Metal Manual."

C. Join individual sections in accordance with the membrane manufacturer's requirements and SMACNA (ASMM) "Architectural Sheet Metal Manual”.

3.09 INSTALLATION - WALKWAY

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
   1. Sweep away loose aggregate surfacing and set walkway pads in additional cold applied adhesive.

B. Walkway Cap Sheet Strips: Install roofing membrane walkway cap sheet strips over roofing membrane by heat weld application.

C. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways.

3.10 HIGH WALL FLASHING INSTALLATION

A. At high wall areas indicated on drawings, roofing membrane will transition from modified bitumen roofing system to TPO.

B. Install sheet flashings and adhere to substrates per membrane roofing system manufacutrer's written instructions.

C. Apply solvent-based bonding adhesive at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into adhesive. Weld side and end laps to ensure a watertight seam installation.

3.11 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide adequate number of experienced workmen regularly engaged in this type of work, skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and an experienced superintendent on the job site at all times that roofing work is in progress.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

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

3.12 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.13 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 07 52 00

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PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. ASTM B32 - Standard Specification for Solder Metal; 2020.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

F. CDA A4050 - Copper in Architecture - Handbook; Current Edition.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.02 WORK INCLUDED

A. Furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this section.

B. The work described in the section of the specifications includes, but is not limited to the following:
   1. Sheet metal roof flashing and counter flashing.
   2. Reglets and metal hold-down clips
   3. Concealed sheet metal flashing at exterior doors.
   4. Sheet metal pitch-pockets at the roof.
   5. Sheet metal roof flashing and pitch-pockets at mechanical and plumbing items which extend through the roof surface.
   6. Gutters, coping, and trim.
   7. Festening hardware such as nails, screws, reglet wedge blocks, etc.

1.03 GENERAL REQUIREMENTS

A. Proper Surfaces: Surfaces to which roofing, and sheet metal are to be applied shall be even, smooth, sound, thoroughly clean and dry, and free from all defects that might affect the application

B. Accessories: All accessories or other /items essential to the completeness of the metal flashing installation, though not specified, shall be provided. All such items, unless otherwise indicated on drawings or specified, shall be of same material as the item to which applied. Nails, screws and bolts shall be of the types best suited for the purpose intended and shall be of a composition that is compatible with the metal to which it will contact.

C. Dissimilar Materials: Where sheet metal abuts or members into adjacent dissimilar materials, the juncture shall be executed in a manner that will prevent electrolysis between the two materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. All exposed to view coping trim, downspouts, fascia and similar metals shall be prefinished.

B. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal.

2.02 PREFINISHED ALUMINUM SHEETS

A. All exposed to view coping trim, downspouts, fascia and similar metals shall be prefinished.

B. Description: Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.

C. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 GUTTERS AND DOWNSPOUTS

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Downspouts: Profile as indicated.

C. Gutters and Downspouts: Size indicated on drawings.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.
   1. Provide 12" x 30" concrete splashblocks at all areas where downspouts are located on soil, bedding, or where as indicated.
   2. Basis of Design Manufacturer: Phoenin Precast or equal

F. Downspout Boots: Cast iron.
   1. Size for approperate angular downspout size and 48" long. Include downspout boot with 3" x 4" gasketed cleanout.
   2. Basis of Design Manufacturer: J.R. Hoe Castin

G. Downspout Extenders: Same material and finish as downspouts.

H. Seal metal joints.

2.05 FLASHING

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.06 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Bituminous Coating: FS TT-C494 or SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, coumpounded for 15-mil dry film th

F. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

G. Reglets: Surface-mounted type, compatible with flashing indicated, noncorrosive.

H. Solder: ASTM B32, Alloy Grade - Sn50 (50/50).

PART 3 EXECUTION

3.01 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.

E. Secure gutters and downspouts in place with concealed fasteners.

F. Connect downspouts to downspout boots, and grout connection watertight.

G. Set splash pads under downspouts, and set in place with _____.

END OF SECTION 07 62 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gutters and downspouts.

B. Downspout boots.

C. Splash guards.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Downspout boots.

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

C. Section 09 91 13 - Exterior Painting: Field painting of metal surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gutters and Downspouts:
   1. Downspoutboots.com, a division of J. R. Hoe & Sons; _____: www.downspoutboots.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GUTTERS AND DOWNSPOUTS

A. Gutters: Profile as indicated in drawings.

B. Downspouts: Rectangular profile.

C. Form gutters and downspouts of profiles and size indicated in construction documents.

D. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14-inch (355 mm) long legs on corner pieces.

E. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: Type recommended by manufacturer.

2.03 DOWNSPOUT BOOTS

A. Description: Smooth interior without boxed corners or choke points; include integral lug slots.
   1. Configuration: Angular.
   2. Downspout Boot size as indicated in construction documents.
   3. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (10 mm), minimum.
   4. Color: As selected by Architect from manufacturer's full range.
   5. Products:
      a. Downspoutboots.com, a division of J. R. Hoe & Sons: www.downspoutboots.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 SPLASH GUARDS

A. Splash Pads: Precast concrete type, profiles sizes as indicated on drawings; minimum 3,000 psi (21 MPa) compressive strength at 28 days, with minimum 5 percent air entrainment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify surfaces are acceptable for product installation in accordance with manufacturer's written instructions.

C. Notify Architect in writing of conditions detrimental to completion of work. Do not proceed with installation until detrimental conditions are corrected.

3.02 PREPARATION

A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mils, 0.015 inch (0.381 mm).

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 1/4 inch per 10 feet (1:480), minimum.

END OF SECTION 07 71 23

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches.

B. Roof Ladders.

C. Cast-iron downspout boots.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:
   1. **Basis of Design:** Bilco Company; Type E-50TB: www.bilco.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Mill finished aluminum, 11 gauge, 0.0907 inch (2.3 mm) thick.
   2. Insulation: Manufacturer's standard; 3 inch (76 mm) rigid polyisocyanurate, located on outside face of curb.
   3. Curb Height: 12 inches (305 mm) , minimum.

C. Metal Covers: Flush, insulated, hollow metal construction.
   1. Capable of supporting 40 psf (1.92 kPa) live load.
   2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch (2.3 mm) thick, liner 0.04 inch (1.0 mm) thick.
   3. Insulation: Manufacturer's standard 3 inch (76 mm) rigid polyisocyanurate.
   4. Gasket: EPDM, continuous around cover perimeter.

D. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.

E. Hardware: Type 316 stainless steel, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.

2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

2.02 ROOF LADDERS

A. Manufacturer:
   1. **Basis of Design:** O'Keeffe's, Inc.; www.okeeffes.com
   2. Contractor can submit substitution request for shop fabricated galvanized steel ladders. All performance requirements must be met. Contractor shall prime and paint steel ladders.

B. Fixed Access Ladder - O'Keeffe's, Inc: Model 501
   1. Provide fixed access ladder below roof hatches and as indicated on drawings.
   2. Contractor to ensure that top run of ladder is within 12 inches from roof hatch.
   3. Provide security door at all ground level exterior ladders.

C. Caged Ladder with Parapet Step - O'Keefee's, Inc.: Model 533
   1. Provide in all other areas as indicated on drawings.
   2. Provide security door at all ground level exterior ladders.

D. Materials
   1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209/B209M.
   2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

E. Fabrication
   1. Rungs: Not less than 1-1/4 inch (32 mm) in section and 18-3/8 inches (467 mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
      a. Rungs shall withstand a 1,500 ound (454 kg) load without deformation or failure.
   2. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.
   3. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surf
   4. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
   5. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
   6. Security Doors: Formed 1/8 inch (3 mm) thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches (51 mm) of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.
   7. Safety Cages:
      a. Fabricate ladder safety cages to comply with authority having jurisdiction. Assembly by welding. Spacing of primary hoops, secondary hoops and vertical bars shall not exceed that required by code.
      b. Safety cage hoops and vertical bars: 3/16 inch (5mm) by 2 inches (51 mm) aluminum bar.

2.03 CAST-IRON DOWNSPOUT BOOTS

A. Manufacturer:
   1. **Basis of Design:** Downspoutboots.com, a division of J. R. Hoe & Sons; A-series, Angular: www.downspoutboots.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Comply with applicable code for size and method of rainwater discharge.

C. Cast-Iron Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
   1. Configuration: Angular.
   2. Length: 36 inches (914 mm).

D. Connectors: Furnish required connector pieces for polyvinyl chloride (PVC) components.

E. Anchors and Supports: Profiled to suit downspouts and downspout boots.
   1. Anchoring Devices: In accordance with SMACNA (ASMM) requirements.

F. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, and flexible rubber coupling.

G. Finish:
   1. Powder-Coat Finish: Manufacturer's standard thermosetting polyester or acrylic urethane powder coating; minimum cured-film thickness of 1.5 mils, 0.0015 inch (0.038 mm).
   2. Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

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.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2026.

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2024.

D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2024.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a, with Editorial Revision (2024).

F. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum five years documented experience installing work of this type.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
   2. CEMCO: www.cemcosteel.com/#sle.
   3. Hilti, Inc: www.hilti.com/#sle.
   4. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
   5. RectorSeal, a CSW Industrials Company: www.rectorseal.com/firestop-solutions/#sle.
   6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

B. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

B. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:
   1. Floor-to-Floor Joints:
      a. 4 Hour Construction: UL System FF-D-0023; RectorSeal MetaCaulk 150+.
      b. 3 Hour Construction: UL System FF-D-1024; RectorSeal MetaCaulk 1200 Spray.
      c. 3 Hour Construction: UL System FF-D-1027; RectorSeal MetaCaulk 150+.
      d. 3 Hour Construction: UL System FF-D-1077; RectorSeal MetaCaulk 835+.
      e. 2 Hour Construction: UL System FF-D-0024; RectorSeal MetaCaulk 150+.
      f. 2 Hour Construction: UL System FF-D-0053; RectorSeal MetaCaulk Joint Strip.
      g. 2 Hour Construction: UL System FF-D-0084; RectorSeal MetaCaulk Joint Strip.
      h. 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      i. 2 Hour Construction: UL System FF-D-1085; Tremco, TREMstop Acrylic Firestop Sealant.
   2. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
      a. 2 Hour Construction: UL System HW-D-0058; RectorSeal MetaCaulk 1200 Spray.
      b. 2 Hour Construction: UL System HW-D-0149; RectorSeal MetaCaulk 150+.
      c. 2 Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      d. 2 Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   3. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
      a. 3 Hour Construction: UL System HW-D-1058; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      b. 3 Hour Construction: UL System HW-D-0166; RectorSeal MetaCaulk 1200 Spray.
      c. 2 Hour Construction: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.
   4. Concrete/Concrete Masonry Wall-to-Wall Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
      a. 2 Hour Construction: UL System WW-S-1025; RectorSeal MetaCaulk 835+.
      b. 2 Hour Construction: UL System WW-S-1038; RectorSeal MetaCaulk 835+.

B. Gypsum Board Walls:
   1. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
      a. 2 Hour Construction: UL System WW-S-0089; RectorSeal MetaCaulk 150+.
   2. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
      a. 2 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
      b. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   3. Head-of-Wall Joints at Underside of Flat Concrete:

a. 4 Hour Construction: UL System HW-D-0108; RectorSeal MetaCaulk 1200 Spray.
b. 2 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
c. 2 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.
d. 2 Hour Construction: UL System HW-D-0016; Tremco, TREMstop Acrylic Firestop Sealant.
e. 2 Hour Construction: UL System HW-D-0017; Tremco, TREMstop Acrylic Firestop Sealant.
f. 2 Hour Construction: UL System HW-D-1072; Tremco, TREMstop Acrylic Firestop Sealant.
g. 1 Hour Construction: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
h. 1 Hour Construction: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.
i. 1 Hour Construction: UL System HW-D-0016; Tremco, TREMstop Acrylic Firestop Sealant.

4. Head-of-Wall Joints at Concrete Over Metal Deck:
   a. 2 Hour Construction: UL System HW-D-0144; RectorSeal MetaCaulk 150+.
   b. 2 Hour Construction: UL System HW-D-0256; Tremco, TREMstop Acrylic Firestop Sealant.
   c. 1 Hour Construction: UL System HW-D-0256; Tremco, TREMstop Acrylic Firestop Sealant.
5. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
   a. 2 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   b. 2 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
   c. 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   d. 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
6. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
   a. 2 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   b. 2 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
   c. 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

2.05 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Blank Openings:
   1. In Floors or Walls:
      a. 4 Hour Construction: UL System C-AJ-0042; RectorSeal MetaCaulk Fire Rated Mortar.
      b. 4 Hour Construction: UL System C-AJ-0088; RectorSeal MetaCaulk Composite Sheet.
      c. 3 Hour Construction: UL System C-AJ-0045; RectorSeal MetaCaulk Fire Rated Putty.
      d. 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      e. 2 Hour Construction: UL System C-AJ-0171; HoldRite HydroFlame 100 Intumescent Firestop Sealant.

B. Penetrations Through Floors or Walls By:
   1. Multiple Penetrations in Large Openings:
      a. 2 Hour Construction: UL System C-AJ-2863; HoldRite HydroFlame 100 Intumescent Firestop Sealant.

b. 3 Hour Construction: UL System C-AJ-8047; RectorSeal MetaCaulk 1000.
c. 3 Hour Construction: UL System C-AJ-8099; Hilti FS-ONE MAX Intumescent Firestop Sealant.
d. 3 Hour Construction: UL System C-AJ-8110; Hilti CFS-BL Firestop Block.
e. 3 Hour Construction: UL System C-AJ-8133; RectorSeal Fire Rated Mortar.
f. 2 Hour Construction: UL System C-AJ-8129; RectorSeal MetaCaulk 1200 Spray.
g. 2 Hour Construction: UL System C-AJ-8149; RectorSeal MetaCaulk 1000.
h. 2 Hour Construction: UL System C-AJ-8171; RectorSeal MetaCaulk Wrap Strip.

2. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 3 Hour Construction: UL System C-AJ-1076; RectorSeal MetaCaulk 950.
   b. 3 Hour Construction: UL System C-AJ-1184; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 3 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   d. 3 Hour Construction: UL System C-AJ-1261; RectorSeal MetaCaulk 1000.
   e. 3 Hour Construction: UL System C-AJ-1320; RectorSeal MetaCaulk 1000.
   f. 3 Hour Construction: UL System C-AJ-1421; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
   g. 3 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
   h. 3 Hour Construction: UL System C-AJ-1718; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   i. 2 and 3 Hour Construction: UL System C-AJ-1696; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   j. 2 Hour Construction: UL System C-AJ-1036; RectorSeal MetaCaulk 950.
   k. 2 Hour Construction: UL System C-AJ-1186; RectorSeal MetaCaulk 950.
   l. 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   m. 2 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
   n. 1 Hour Construction: UL System C-AJ-1039; RectorSeal MetaCaulk 950.
3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   a. 3 Hour Construction: UL System C-AJ-2842; HoldRite HydroFlame Pipe Collar.
   b. 3 Hour Construction: UL System C-AJ-2848; HoldRite HydroFlame Wrap Strip and HydroFlame 200 Intumescent Firestop Sealant.
   c. 3 Hour Construction: UL System C-AJ-2851; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   d. 3 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
   e. 3 Hour Construction: UL System C-AJ-2151; RectorSeal MetaCaulk 1200.
   f. 3 Hour Construction: UL System C-AJ-2220; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   g. 3 Hour Construction: UL System C-AJ-2342; Hilti CP-E/S Firestop Wrap Strip.
   h. 3 Hour Construction: UL System C-AJ-2661; RectorSeal MetaCaulk 1000.
   i. 2 and 3 Hour Construction: UL System C-AJ-2843; HoldRite HydroFlame Pipe Collar.
   j. 2 Hour Construction: UL System C-AJ-2047; RectorSeal MetaCaulk 1000.
   k. 2 Hour Construction: UL System C-AJ-2167; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   l. 2 Hour Construction: UL System C-AJ-2348; RectorSeal MetaCaulk 150+.
   m. 2 Hour Construction: UL System C-AJ-2707; RectorSeal MetaCaulk 1000.
   n. 2 Hour Construction: UL System C-BJ-2021; Hilti CP 643N Firestop Collar.
4. Electrical Cables Not In Conduit:

a. 3 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
b. 3 Hour Construction: UL System C-AJ-3208; Hilti CP 618 Firestop Putty Stick.
c. 3 Hour Construction: UL System C-AJ-3360; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
d. 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
e. 2 Hour Construction: UL System C-AJ-3283; Hilti CP653 Speed Sleeve.
f. 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit.
g. 2 Hour Construction: UL System C-AJ-3283; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
h. 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.
i. 2 Hour Construction: UL System F-A-3085, F-A-3087, F-A-3088, W-J-3277, W-J-3278, W-J-3279, W-L-3481, W-L-3482, W-L-3483, and W-L-3484.; Hilti CFS-MSL L Modular Sleeve.

5. Cable Trays with Electrical Cables:
   a. 3 Hour Construction: UL System C-AJ-4093; Hilti CFS-BL Firestop Block.
   b. 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.
6. Electrical Busways:
   a. 3 Hour Construction: UL System C-AJ-6017; Hilti FS-ONE MAX Intumescent Firestop Sealant.
7. Insulated Pipes:
   a. 3 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 3 Hour Construction: UL System C-AJ-5410; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, CP 604 Self-Leveling Firestop Sealant or CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
   d. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX Intumescent Firestop Sealant.
8. HVAC Ducts, Uninsulated:
   a. 3 Hour Construction: UL System C-AJ-7051; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 3 Hour Construction: UL System C-AJ-7204; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

C. Penetrations Through Walls By:
1. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 3 Hour Construction: UL System C-AJ-1700; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. Electrical Cables Not In Conduit:
   a. 2 Hour Construction: UL System C-AJ-3357; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
3. Insulated Pipes:

a. 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
b. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
c. 2 Hour Construction: UL System C-AJ-5407; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
d. 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
e. 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

4. HVAC Ducts, Uninsulated:
   a. 3 Hour Construction: UL System C-AJ-7204; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-J-7092; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
5. HVAC Ducts, Insulated:
   a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.06 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
   1. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   2. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

B. Penetrations By:
   1. Multiple Penetrations in Large Openings:
      a. 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      b. 2 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
      c. 2 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      d. 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      e. 1 and 2 Hour Construction: UL System W-L-1568; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      f. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      g. 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      h. 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 3 and 4 Hour Construction: UL System W-L-1560; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
      b. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      c. 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
      d. 2 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
      e. 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      f. 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
      g. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.

h. 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
i. 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.

3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   a. 4 Hour Construction: UL System W-L-2704; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
   c. 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   d. 1 and 2 Hour Construction: UL System W-L-2710; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   e. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
   f. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4. Electrical Cables Not In Conduit:
   a. 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   b. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   c. 2 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
   d. 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
   e. 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit.
   f. 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit with Hilti CFS-SL GP Gangplate.
   g. 2 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
   h. 1 and 2 Hour Construction: UL System W-L-3453; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   i. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   j. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   k. 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.
   l. 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
5. Cable Trays with Electrical Cables:
   a. 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
   c. 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
6. Insulated Pipes:
   a. 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
   d. 1 and 2 Hour Construction: UL System W-L-5357; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
7. HVAC Ducts, Insulated:
   a. 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

b. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.07 FIRESTOPPING SYSTEMS

A. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches (100 mm) or less: Caulk or putty.

B. Firestopping at Combustible Pipe and Conduit Penetrations, of diameter 4 inches (100 mm) or less: Any material meeting requirements.

C. Firestopping at Cable Penetrations, not in Conduit or Cable Tray: Caulk or putty.

D. Firestopping at Control Joints (without Penetrations): Any material meeting requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

D. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

E. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2025).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Contractor to provide locations and material conditions of sealant. If sealant location and material conditions are not provided, submittal shall be rejected.

E. Executed warranty.

1.04 QUALITY ASSURANCE

A. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
   5. Preform five tests for the first 1,000 feet of joint length for each type of elastomeric sealant and joint substrate. Preform one test for each 1,000 feet of joint length there
   6. Inspect joints for complete fill, for absence of voids, for primer if required, for proper width/depth ratio and back up complying with specified requirements. Record results in an
   7. Repair sealants pulled in test area by applying new sealants following same procedures used to orginally seal joints. Contractor shall test and repair test areas at no expense to th

B. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints:
      a. Seal open joints except open joints indicated on drawings as not sealed.
   2. Interior Joints:
      a. Seal the following joints:
         1) Joints between door frames, window frames, and other frames and adjacent construction.
         2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
         3) Seal interior perimeters of exterior openings.
         4) Expansion and control joints on interior of exterior cast-in-place concrete walls.
         5) Expansion and control joints on interior of exterior precast, architectural wall panels.
         6) Expansion and control joints on interior of exterior surfaces of masonry walls.
         7) Interior masonry vertical control joints and intersecting masonry walls; CMU-to-CMU, CMU-to-concrete.
   3. Do Not Seal:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be covered with manufactured expansion joint cover assemblies or other covering devices.
      c. Joints where sealant installation is specified in other sections.

B. Exterior Joints:
   1. Perimeters of exterior openings where frames and other penetrations meet exterior façade of building: precast concrete, brick, CMU, polymer reinforced concrete.
      a. Type 4 - Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
      b. Type 1 - Prefinished Materials Only: One-part Silicones: ASTMC920, Type S, Grade NS, Class 25. Vertical surfaces only.
   2. Expansion and control joints in exterior surfaces of cast-in-place concrete walls, precast architectural wall panels.
      a. Type 4 - Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
      b. Type 6 - One-part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25.
      c. Bond Breaker Tape
   3. Expansion and control joints in exterior surfaces of unit masonry walls, and polymer reinforced concrete, including at metal panels, and all exterior joints in cast stone.
      a. Type 4 - Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
   4. Coping joints, coping-to-façade joints, cornice and wash, or horizontal surface joints not subject to foot or vehicular traffic.
      a. Type 4 - Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
      b. Type 6 - One-part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25.
      c. Type 1 - Prefinished Materials Only: Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
   5. Exterior joints in horizontal wearing and non-wearing surfaces.
      a. Type 3 - Two-part Urethane: Self-Leveling, ASTM C920, Type M, Grade P, Class 25.
      b. Type 5 - One-part Urethane: Self-Leveling, ASTM C920, Type S, Grade P, Class 25.

c. Bond Breaker Tape

6. Paving joints and curbs.
   a. Type 6 - One-part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25.
   b. Type 1 & 2 - Silcone: ASTM C920
7. Setting bed for threshold and saddles.
   a. Type 1 - One-part Silicones: ASTMC920, Type S, Grade NS, Class 25.
8. Painted metal lap or flashing joints.
   a. One-part Silicones: ASTMC920, Type S, Grade NS, Class 25.

C. Interior Joints:
1. Seal interior perimeters of exterior openings.
2. Expansion and control joints on interior of exterior cast-in-place concrete walls.
3. Expansion and control joints on interior of exterior precast, architectural wall panels.
4. Expansion and control joints on interior of exterior surfaces of masonry walls.
5. Perimeters of interior hollow metal and aluminum frames.
6. Interior masonry vertical control joints and intersecting masonry walls; CMU-to-CMU, CMU-to-concrete.
7. For all the above interior joints (1-6):
   a. Type 4- Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
   b. Type 6- One-part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25.
   c. Type 1- Prefinished Materials Only: Two-Part Urethane: Non-Sag ASTM C920, Grade NS, Class 25.
8. Exposed interior control joints in drywall and concealed joints.
   a. Type 7- One-part Acrylic Latex, Non-Sag, ASTM C834-76.
   b. Backer Rod - Closed cell Foam
9. Perimeter of toilet fixtures: sinks, tubs, urinals, water closets, basins, vanities, etc.
   a. Type 7- One-part Acrylic Latex, Non-Sag, ASTM C834-76.
10. Interior expansion and control joints in floor surfaces exposed to foot traffic.
   a. Type 3- Two-part Urethane: Self-Leveling, ASTM C920, Type M, Grade P, Class 25.
   b. Type 5 - One-part Urethane: Self-Leveling, ASTM C920, Type S, Grade P, Class 25.
   c. Bond Breaker Tape
11. Painted metal lap joints:
   a. Type 1 - One-part Silicones: ASTMC920, Type S, Grade NS, Class 25. Vertical surfaces only.
12. Glazing:
   a. General Purpose Glazing
   b. Type 1 - One-part Silicones: ASTMC920, Type S, Grade NS, Class 25. Vertical surfaces only.

D. Interior Wet Areas: Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

2.02 NONSAG JOINT SEALANTS

A. Type 1 - Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M, A, G, and O; not expected to withstand continuous water immersion or traffic.
1. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Products:
   a. Dow; DOWSIL 795 Silicone Building Sealant: www.dow.com/#sle.
   b. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com/#sle.
   c. Sika Corporation; WS-305 AM50: usa.sika.com/#sle.
   d. Sika Corporation; Sikasil WS-295: usa.sika.com/#sle.

B. Type 2 - Silicone Sealant: ASTM C920, Grade NS, Class 25.
   1. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Cure Type: Mildew-resistant acetoxy-curing.
   4. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
   5. Products:
      a. Dow; DOWSIL 786 Mildew-resistant Silicone Sealant: www.dow.com/#sle.
      b. General Electric; SCS 1700 Sanitary Sealant
      c. Pecora Corporation; Pecora 898: www.pecora.com/#sle.
      d. Sika Corporation; Sikasil GP: usa.sika.com/#sle.
      e. Sika Corporation; Sikasil-N Plus US: usa.sika.com/#sle.

C. Type 3 - Polyurethane Sealant: ASTM C920, Grade P, Type M; multi-component
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   3. Products:
      a. Pecora Corporation; NR-200 Urexpan: www.pecora.com/#sle.
      b. Sika Corporation; Sika-Flex-2C NS/SL: usa.sika.com/#sle.
      c. Sika Corporation; Sika-Flex NY100: usa.sika.com/#sle.
      d. Tremco Commercial Sealants & Waterproofing; Vulkem 455SSL: www.tremcosealants.com/#sle.
      e. Bostik; Chem-Caulk CC-550.

D. Type 4 - Polyurethane Sealant: ASTM C920, Grade NS, Type M; multi-component
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   3. Products:
      a. Pecora Corporation; Dyermic 240FC: www.pecora.com/#sle.
      b. Pecora Corporation; Dynatrol II: www.pecora.com/#sle.
      c. Sika Corporation; Sika-Flex-2C NS/SL: usa.sika.com/#sle.
      d. Sika Corporation; Sika-Flex NY100: usa.sika.com/#sle.
      e. Sika Corporation; Sikaflex NP 2: usa.sika.com/#sle.
      f. Tremco Commercial Sealants & Waterproofing; Vulkem 455SSL: www.tremcosealants.com/#sle.
      g. Bostik; Chem-Caulk CC-550.

E. Type 5 - Polyurethane Sealant: ASTM C920, Grade P, Type M; single component.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   3. Products:
      a. Pecora Corporation; NR-201 Urexpan: www.pecora.com/#sle.
      b. Sika Corporation; Sika-Flex SL1: usa.sika.com/#sle.
      c. Tremco Commercial Sealants & Waterproofing; Vulkem 45: www.tremcosealants.com/#sle.

F. Type 6 - Polyurethane Sealant: ASTM C920, Grade NS, Types S; single component.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   4. Products:
      a. Sika Corporation; Sikaflex NP 1: usa.sika.com/#sle.
      b. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.

c. Tremco Commercial Sealants & Waterproofing; Vulkem 116: www.tremcosealants.com/#sle.
d. Bostik; Chem-Caulk CC-550.

G. Type 7 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Products:
a. Bosstikl Chem-Calk 600
b. MACCO Adhesives, The Glidden Company; LC-130
c. Pecora Corporation; AC-20 +Silicone: www.pecora.com/#sle.
d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
e. W.R. Meadows, Inc; Easa-Ply ALS

H. Type 8 - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Products:
a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant: www.pecora.com/#sle.
b. Bostik; Chem-Calk 300.
c. Tremco Commercial Sealants & Waterproofing; TremPro JS733+: www.tremcosealants.com/#sle.

2.03 ACCESSORIES

A. Sealant Backing Rod, Closed-Cell Type:
1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
2. Size: 25 to 50 percent larger in diameter than joint width.
3. Products:
a. Nomaco, Inc; HBR: www.nomaco.com/#sle.
b. Nomaco, Inc; #92 Greenrod: www.nomaco.com/#sle..

B. Sealant Backing Rod, Open-Cell Type:
1. Cylindrical flexible sealant backings complying with ASTM C1330 Type O.
2. Size: 25 to 50 percent larger in diameter than joint width.
3. Products:
a. Nomaco, Inc; Foam Pack II: www.nomaco.com/#sle.
b. Backer Rod Mfg, Inc; Denver Foam.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

D. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions”.
2. Division 04 Section "Masonry".
3. Division 06 Section “Rough Carpentry”.
4. Division 06 Section “Finish Carpentry”.
5. Division 08 Section “Operations and Maintenance”.
6. Division 08 Section “Interior Aluminum Doors and Frames”.
7. Division 08 Section “Flush Wood Doors”.
8. Division 08 Section “Fiberglass Doors”,
9. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
10. Division 08 Section "Glazing".
11. Division 08 Section "Door Hardware”.
12. Division 09 Sections "Painting".
13. Division 26 Section "Electrical”

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. SDI-113 Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door & Frame Assemblies.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM C1199 - Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
12. ASTM E1423 - Practice for Determining Steady State Thermal Transmittance of Fenestration Systems.
13. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
14. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
15. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
16. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
17. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
18. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
19. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. Curries Company (CU) - M Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. Curries Company (CU) - CM Series.
    b. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where

practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
5. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:

        1) Two anchors per jamb up to 60 inches high.

2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

8. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
9. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 08 11 13

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.04 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
   1. Screw-Holding Capacity: Tested to 890 pounds (404 kg), minimum.
   2. Surface Burning Characteristics: Flame spread index (FSI) of 0 to 25, Class A, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
   3. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
   4. Clearance Between Door and Frame: 1/8 inch (3 mm), maximum.
   5. Clearance Between Bottom of Door and Finished Floor: 3/4 inch (19 mm), maximum; not less than 1/4 inch (6 mm) clearance to threshold.

2.02 COMPONENTS

END OF SECTION 08 16 13

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PART 2 PRODUCTS

1.01 COMPONENTS

A. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

B. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

C. Head Weatherstripping: EPDM rubber seal, one piece full length.

D. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

E. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

END OF SECTION 08 36 13

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Firestop at system junction with structure.

B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

D. Section 08 80 00 - Glazing: Glass and glazing accessories.

E. Section 09 91 23 - Interior Painting: Field painting of interior surface of infill panels.

F. Section 12 24 00 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS

A. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2026.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

H. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

I. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, fabrication methods, finishing, accessories and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required. Include the following

1. Elevations.
2. Detail sections of typical composite members.
3. Hardware, mounting heights.
4. Anchorages and reinforcements.
5. Expansion provisions.
6. Glazing details.

D. Samples: Submit 1 samples 12 inches (300 mm) in size illustrating finished aluminum surface, glass, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least _____ years of documented experience.
   1. Provide certified glass products through ANSI-accredited certifications that include plant audits and independent laboratory performance testing.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Locate as indicated on drawings.

C. Mock-up may remain as part of work.

D. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefronts:
   1. Kawneer North America; _____: www.kawneer.com/#sle.
   2. Oldcastle BuildingEnvelope; _____: www.oldcastlebe.com/#sle.
   3. YKK AP America, Inc; _____: www.ykkap.com/commercial/#sle.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Position: Centered (front to back).
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).
   3. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
   4. Finish Color: As indicated on drawings.
   5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of applicable code.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
   3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.

B. Glazing: See Section 08 80 00.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: 4 inches (100 mm) wide.

3. Finish: Same as storefront.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

E. Concealed Flashings: Sheet aluminum, 26 gauge, 0.017 inch (0.43 mm) minimum thickness.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Glazing Accessories: See Section 08 80 00.

2.05 FINISHES

A. Color: As indicated on drawings.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

A. Other Door Hardware: Storefront manufacturer's standard type to suit application.
   1. Finish on Hand-Contacted Items: Polished chrome.
   2. For each door, include butt hinges, pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work. shall include but not be limited to:
   1. Verify rough opening dimensions.Verify levelness of sill plate.
   2. Verify operational clearances.
   3. Ensure masonry surfaces are visibly dry and free of excess mortar, sand, and other construction debris.
   4. Ensure wood frame walls are dry, clean, sound, well nailed, free of voids, and without offsets at joints.
   5. Ensure that nail heads are driven flush with surfaces in opening and within 3" of opening.Ensure metal surfaces are dry clean, free of grease, oil, dirt, rust, corrosion, and welcing slab.
   6. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

K. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 80 00.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
      a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
   4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).
      a. Maximum allowable rate of air leakage is 0.09 cfm/sq ft (0.5 L/s sq m).

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Clean glass immediately after installation.
   1. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.

C. Upon installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610

D. Avoid damaging protective coatings and finishes.

E. Remove excess sealants, glazing materials, dirt, and other substances.

F. Repair or replace damaged installed products.

G. Remove and replace glass that has been broken, chipped, cracked, abraded, during construction period.

H. Remove construction debris from project site and legally dispose of debris.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 43 13

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.02 RELATED REQUIREMENTS

A. Section 07 52 00 - Modified Bituminous Membrane Roofing: Flashing-in of skylight base.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

E. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.

F. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2026.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

H. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.

I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2026.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

K. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for each product.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. ICC-ES evaluation report.

C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

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

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 10-year manufacturer warranty for tubular skylights. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solatube International, Inc; SkyVault M74: www.solatube.com/#sle.

B. Solatube International, Inc; SolaMaster: www.solatube.com/#sle.

C. Local representative Eric Clendenin eric@ntxbuildingproducts.com

D. Substitutions: See Section 01 60 00 - Product Requirements.
   1. Substitutions will be considered provided a lighting layout with 3rd party verified photometric data is supplied to demonstrate illuminance levels that will meet original design intent.

2.02 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
   1. Fabrication and assembly of components is by single manufacturer.
   2. Non-Metal Parts: Flammability less than the following.
      a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
      b. Self-Ignition Temperature: Greater than 650 degrees F (343 degrees C), when tested in accordance with ASTM D1929.
      c. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E84; or maximum rating of 75, when tested in accordance with ASTM D2843.
      d. Combustibility - Light Transmitting Parts: Burning extent of 2.5 inches/minute (1.06 mm/second) or less (ICC Class CC-2), when tested in accordance with ASTM D635 in the thickness intended for use.

B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
   1. Glazing: Acrylic plastic, 1/8 inch (3.2 mm) minimum thickness.
   2. Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
   3. Base Material: Sheet steel, galvanized, ASTM A653/A653M, 24 gauge, 0.0239 inch (0.61 mm) thick, minimum.

4. Dome Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.

C. Reflective Tube: ASTM B209/B209M aluminum sheet, thickness between 0.015 inch (0.4 mm) and 0.020 inch (0.5 mm).
   1. Interior Finish: Exposed interior surfaces of high reflectance specular finish; specular reflectance of 92, total reflectance 95 percent.

D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
   1. Ceiling Ring: Edge trim for ceiling opening; injection molded high impact ABS.
   2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
   3. Diffuser Shape at Solid Ceilings: Round, same diameter as tube.
   4. Diffuser Shape in Lay-In Ceiling Grid: Square, 24 by 24 inches (610 by 610 mm), to fit grid; metal transition box.
   5. Diffuser Shape at No Ceiling: Round, same diameter as tube.
   6. Lens: Flush frosted lens.
   7. Lens Material: Acrylic plastic.
   8. Visible Light Transmission (VLT): 90 percent, minimum.
   9. Seal: Closed cell EPDM foam rubber.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific tubular skylight:
   1. Product Type: Tubular Daylighting Device, Closed Ceiling (TDDCC).

B. Air Leakage: 0.30 cfm/sq ft (1.5 L/sec sq m) maximum leakage for tubular skylight unit when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

C. Water Resistance: No uncontrolled water leakage at 6.27 psf (300 Pa) pressure differential with water rate of 5 gallons/h/sf (206 L/h/sq m), when tested in accordance with ASTM E331; designed to ensure that water will not accumulate inside assembly.

2.04 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Sealant: Elastomeric, silicone or polyurethane; compatible with materials being sealed.

PART 3 EXECUTION

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.

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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Set roof assembly flashing in continuous bead of sealant.

C. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.

D. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 08 62 23

SECTION 08 71 00 - DOOR HARDWARE

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 commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.

C. Related Sections:

1. Division 01 Section "General Conditions”.
2. Division 06 Section “Rough Carpentry”.
3. Division 06 Section “Finish Carpentry”.
4. Division 08 Section “Operations and Maintenance”.
5. Division 08 Section “Door Schedule”.
6. Division 08 Section “Door Hardware Schedule”.
7. Division 08 Section “Hollow Metal Doors and Frames”.
8. Division 08 Section “Interior Aluminum Doors and Frames”.
9. Division 08 Section “Flush Wood Doors”.
10. Division 08 Section “Fiberglass Doors”,
11. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
12. Division 26 Section "Electrical”

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.

c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Door Opening Field Inspection (Punch Report): Provide Door Opening Field Inspection Report as required by Division 01 upon completion of opening inspection, organized by door identifier (mark), and including; individually identified deficiencies associated with assembly components, related opening images and video recordings, and opening remarks.

C. Fire Door Assembly Inspection: Provide Fire Door Assembly Inspection Report upon completion of fire door inspection as required by Division 01 and NFPA 80, section 5.2.2.4.

D. Protective Door Assembly Inspection: Provide Protective Door Assembly Inspection Report upon final completion of non-rated and fire rated egress door inspection as required by Division 01 and NFPA 80, section 5.2.2.4.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary

materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.3 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

   a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.4 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

   a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

   a. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

   a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
   b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

   a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
3. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
5. Manufacturers:

    a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. Sargent Manufacturing (SA).

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.

1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
2. Manufacturers:

    a. Corbin Russwin (RU) - Access 3 AP.
    b. Sargent (SA) - Degree DG1.
    c. No Substitution.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

    a. Lund Equipment (LU).

b. MMF Industries (MM).
c. Telkee (TK).

2.9 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Heavy duty 12-gauge wrought steel case.
b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1” projection deadbolt.
c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
d. Status indicators inside, outside, or on both sides of doors as specified; available with wording for “locked/unlocked”, “vacant/occupied” or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
e. Ten-year limited warranty for mechanical functions.

2. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Motorized electric latch retraction where the latchbolt retracts in 0.5 seconds of power being applied; removing power allows the latch to project back to the extended position. Motorized latch retraction force exceeds ANSI/BHMA 50 lbs. warped door test.
d. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
e. Optional high security monitoring with internal end-of-line monitoring alongside deadbolt privacy and integrated door position monitoring.
f. Two-year limited warranty on electrified functions.

3. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.
b. Sargent Manufacturing (SA) - 8200 Series.

2.10 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Meets ANSI/BHMA A156.41 for single motion egress.
b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
c. Exceeds ANSI/BHMA A156.2 requirements by 2.6 times for 3,100 in-lb. abusive locked lever torque with no entry while maintaining egress.
d. Exceeds ANSI/BHMA A156.2 requirements by 8 times for 1,600 lbs. offset lever pull with no entry for protection against attacks.
e. Exceeds ANSI/BHMA A156.3 requirements by 2 times for latch retraction with 100 lb. preload while maintaining operation in warped doors.
f. Exceeds ANSI/BHMA A156.3 requirements by 20 times for no access with minimum 100 vertical impacts for protection against vandalism attempts.
g. Independent return springs allow lock to exceed ANSI/BHMA A156.2 Grade 1 cycle requirements without lever sag.
h. Ten-year limited warranty for mechanical functions.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - CLX3300 Series.
b. Sargent Manufacturing (SA) - 10X Line.

2.11 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

    a. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    b. Five-year limited warranty for mechanical features.

2. Electromechanical exit devices shall have the following functions and features:

    a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
    b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
    c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
    d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
    e. Five-year limited warranty for electromechanical features.

3. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.

b. Sargent Manufacturing (SA) - 80 Series.

2.13 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - DC6000 Series.
b. Sargent Manufacturing (SA) - 351 Series.

2.14 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:

a. Meets ADA requirements for smooth bottom door surfaces.
b. UL Classified options for use on fire-rated doors up to 3 hours.
c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.

e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
f. Fasteners included; adhesive-backed options available for select models.
g. Ten-year limited warranty.

2. Manufacturers:

a. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood (RO).

B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.17 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

B. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
c. Enhanced surge immunity for input/output protection
d. Separate, dedicated battery charging circuit to keep locks cooler.
e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
f. Instant auto-switch to battery on AC loss.
g. Expandable up to 16 outputs in the standard enclosure
h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
j. Lifetime replacement, no-fault, no questions asked warranty.

2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Paint prime coated mullions to match frames.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. SA - SARGENT
6. OT - Other

Hardware Sets

Set: 1.0
Doors: 113, 123
Description: Ext, Alum, Corridor/Drop Off, Access Control

1	Continuous Hinge	CFM__SLF-HD1 PT		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 CPS	EN	SA
1	Rain Guard	346C		PE
1	Gasketing	By Door/Frame Manufacturer		OT
1	Sweep	315CN		PE
1	Threshold-Ext, Outswing	2005AT		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 2.0
Doors: 101A
Description: Ext, Alum, PR, Entrance, Access Control

2	Continuous Hinge	CFM__SLF-HD1 PT		PE
2	Electric Power Transfer	EL-CEPT	630	SU
1	Mullion	L980A	US28	SA
1	Rim Exit Device, Storeroom	DG164 55 56 8804 Less Pull	US32D	SA
1	Rim Exit Device, Dummy	55 8810 Less Pull	US32D	SA
2	Core	DG1 As Required	US15	SA
1	Mullion Cylinder	980C1	US26D	SA
2	Offset Door Pull	RM3310-36	US32D	RO
2	Surface Closer	351 CPS	EN	SA
1	Rain Guard	346C		PE
1	Gasketing	By Door/Frame Manufacturer		OT
2	Sweep	315CN		PE
1	Threshold-Ext, Outswing	2005AT		PE
1	Card Reader	Provided By Security Supplier		OT
2	ElectroLynx Harness	QC-C**** x Length Required		MK
2	ElectroLynx Harness	QC-C1500P		MK
2	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 3.0
Doors: 115A, 115B, 128A, 143
Description: Ext, Corridor/Elec, Access Control

3	Hinge, Full Mortise, Hvy Wt	T4A3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit Device, MELR	DG164 55 56 8804 ETL	US32D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 CPS	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346C		PE
1	Sweep	315CN		PE
1	Threshold-Ext, Outswing	2005AT		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 4.0
Doors: 129B, 150
Description: Ext, PR, Food Prep/Riser

6	Hinge, Full Mortise, Hvy Wt	T4A3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555	US26D	RO
1	Storeroom/Closet Lock	DG164 8204 LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
2	Surface Closer	351 CPS	EN	SA
2	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
2	Astragal	303APK		PE

1	Gasketing	303AS		PE
1	Rain Guard	346C		PE
2	Sweep	315CN		PE
1	Threshold-Ext, Outswing	2005AT		PE

Set: 5.0
Description: SET NOT USED

Set: 6.0
Doors: 139A, 139B
Description: Ext, Sallyport, Access Control

3	Hinge, Full Mortise, Hvy Wt	T4A3386xNRP 5" x 4-1/2"	US32D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 CPS	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346C		PE
1	Sweep	315CN		PE
1	Threshold-Ext, Outswing	2005AT		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 7.0
Doors: 125
Description: Dutch Door, Office, Access Control

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Hinge, Full Mortise	TA2714 QC* 4-1/2" x 4-1/2"	US26D	MK
1	Surface Bolt	630-4	US26D	RO
1	Fail Secure Lock	DG164 RX 10XG71 LL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
2	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE

1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT
1	Dutch Door Shelf	Provided by Door Manufacturer		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 8.0
Doors: 106, 107, 114, 116, 117
Description: Alum, Cat Play/Dog GTK

1	Continuous Hinge	CFM__SLF-HD1		PE
1	Office/Entry Lock	DG164 8205 LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	By Door/Frame Manufacturer		OT
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE

Notes: The hardware specified is listed as a basis of design. Coordinate requirements with Alum Door/Frame Manufacturer.

Set: 9.0
Doors: 113B
Description: Alum, Corridor

1	Continuous Hinge	CFM__SLF-HD1		PE
1	Passage Latch	8215 LNL	US26D	SA
1	Surface Closer	351 O/P9	EN	SA
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	By Door/Frame Manufacturer		OT

Notes: The hardware specified is listed as a basis of design. Coordinate requirements with Alum Door/Frame Manufacturer.

Set: 10.0
Doors: 101B
Description: Alum, PR, Vestibule

2	Continuous Hinge	CFM__SLF-HD1		PE
2	BTB Door Pull	RM3300-36 Mtg-Type 5HD	US32D	RO
2	Surface Closer	351 CPS	EN	SA
1	Gasketing	By Door/Frame Manufacturer		OT

Notes: The hardware specified is listed as a basis of design. Coordinate requirements with Alum Door/Frame Manufacturer.

Set: 11.0
Doors: 103
Description: Reception, Access Control

3	Hinge, Full Mortise	TA2714xNRP 4-1/2" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 11.1
Doors: 109, 122B, 128B
Description: Reception/Corridor, Access Control

3	Hinge, Full Mortise	TA2714xNRP 4-1/2" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO

1	Gasketing	S88BL	PE
1	Card Reader	Provided By Security Supplier	OT
1	ElectroLynx Harness	QC-C**** x Length Required	MK
1	ElectroLynx Harness	QC-C1500P	MK
1	Position Switch	DPS-M-BK	SU
1	Power Supply	Provided By Security Supplier	OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 12.0
Doors: 108, 140, 141A
Description: Cat Adoption/Medical/Storage, Access Control

3	Hinge, Full Mortise	TA2714 5" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 13.0
Doors: 118, 119, 120, 121, 136, 137
Description: Dog Adoptable/Quarantine/Isolation/Stray, Access Control

3	Hinge, Full Mortise	TA2714 5" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Acoustic Seal Set	PEMKOSTCSET	BL	PE
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 14.0
Doors: 122A, 135, 138
Description: Drop Off/IT/Janitor

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.

4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 15.0
Doors: 130A, 131A
Description: Intake/Dry Food Storage, Access Control

3	Hinge, Full Mortise	TA2714xNRP 5" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 CPS	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Gasketing	S88BL		PE
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 16.0
Doors: 129A
Description: FRP, Food Prep, Access Control

3	Hinge, Full Mortise	TA2714 5" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Concealed Overhead Stop	690S Series	EN	SA
1	Surface Closer	351 O	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Gasketing	S88BL		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU

1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 17.0
Doors: 131B, 141B
Description: Dry Storage/Medical, Access Control

3	Hinge, Full Mortise	TA2714 5" x 4-1/2"	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Fail Secure Lock	DG164 RX 8271-24V LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Concealed Overhead Stop	690S Series	EN	SA
1	Surface Closer	351 O	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Gasketing	S88BL		PE
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE
1	Card Reader	Provided By Security Supplier		OT
1	ElectroLynx Harness	QC-C**** x Length Required		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Position Switch	DPS-M-BK		SU
1	Power Supply	Provided By Security Supplier		OT

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Lockset REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 18.0
Doors: 134
Description: Breakroom

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	DG164 8237 LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE

Set: 19.0
Description: SET NOT USED

Set: 20.0
Doors: 110, 111, 112
Description: FRP, Cat ISO/Quar/Stray

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	CPC(SS)	MK
1	Classroom Lock	DG164 8237 LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 O/P9	EN	SA
1	Armor Plate	K1050 48" High LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE

Set: 21.0
Doors: 142
Description: Freezers

3	Hinge, Full Mortise	TA2714xNRP 5" x 4-1/2"	US26D	MK
1	Classroom Lock	DG164 8237 LNL	US26D	SA
1	Core	DG1 As Required	US15	SA
1	Surface Closer	351 CPSH	EN	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Gasketing	S88BL		PE
1	Door Bottom	411ANBL		PE
1	Threshold	171A		PE

Set: 22.0
Doors: 104, 105, 132, 133
Description: Restroom/Quite Room

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	V11 8265 LNL	US26D	SA
1	Surface Closer	351 O/P9	EN	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Mop Plate	K1050 4" x 1" LDW CSK BEV	US32D	RO
1	Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1	Gasketing	S88BL		PE
1	Coat Hook	RM801	US26D	RO

Set: 23.0
Doors: 139C, 139D
Description: Overhead Door

1 All Hardware	By Door Manufacturer	OT

END OF SECTION 08 71 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

C. Section 08 41 26 - All-Glass Entrances and Storefronts: Glazing provided as part of entrance assembly.

D. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C1036 - Standard Specification for Flat Glass; 2025.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

J. ASTM E283 – Test method for rate of air leakage through exterior windows, curtain walls, and doors.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

L. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials; 2019.

M. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2026.

N. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

O. GANA (GM) - GANA Glazing Manual; 2022.

P. GANA (SM) - GANA Sealant Manual; 2008.

Q. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

R. NFRC 100 - Procedure for Determining Fenestration Product U-Factors; 2026.

S. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

T. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2026.

U. NGA (LGRM) - Laminated Glazing Reference Manual; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two one samples 12 by 12 inch (300 by 300 mm) in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

H. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), IGMA TM-3000, and NGA (LGRM) for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.
   1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
      a. North American Contractor Certification (NACC) for glazing contractors.

C. Identification: Each unit of tempered glass shall be permanently identified by the manufacturer. The identification shall be etched, or ceramic fire on the glass and be visible when the unit is glazed.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, store, and protect products to site under provisions of General Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Manufacturers:
   1. Basis of Design: Vitro Architectural Glass (formerly PPG Glass); : www.vitroglazings.com/#sle.
   2. Guardian Glass, LLC; _____: www.guardianglass.com/#sle.
   3. Pilkington North America Inc; _____: www.pilkington.com/na/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Plastic Films Manufacturers:
   1. 3M Window Film: solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

D. Windborn Debris & Impact Resistance: Exterior glazing shall comply with basic protection testing requirements in ASTM E1996 for criteria listed on Structural design notes when tested according to ASTM E1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on project.
   1. Large-Missle Test: For glazing located within 30 feet (9.1 meters) of grade.
   2. Small-Missle Test: For glazing located more than 30 feet (9.1 meters) above grade.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Guardian Glass, LLC; _____: www.guardianglass.com/#sle.
   2. Vitro Architectural Glass (formerly PPG Glass); Clear Solarban 90: www.vitroglazings.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.

2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Warm-Edge Spacers: Low-conductivity thermoplastic with desiccant warm-edge technology design or as recommended by manfacturer.
    a. Spacer Width: As required for specified insulating glass unit.
    b. Spacer Height: Manufacturer's standard.
4. Spacer Color: Black.
5. Edge Seal:
    a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
    b. Color: Black.
6. Purge interpane space with dry air, hermetically sealed.

C. Type 1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Tint: Clear.
    b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum. Provide heat treated or tempered safety glass as indicated on drawings or where required by code.
    a. Tint: Clear.
5. Total Thickness: 1 inch (25.4 mm).
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.27, nominal.
7. Visible Light Transmittance (VLT): 51 percent, nominal.
8. Shading Coefficient: 0.27, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
10. Visible Light Reflectance, Outside: 12 percent, nominal.

D. Type 2 - Acoustic Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated Kennels and where indicated in drawings.
2. Space between lites filled with air.
3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Tint: Clear.
    b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum. Provide heat treated or tempered safety glass as indicated on drawings or where required by code.
    a. Tint: Clear.
5. Sound Transmission Class (STC) rating of 42, with special acoustical spacer and edge seal. Shall be in accordance with GANA (GM).
6. Total Thickness: 1 inch (25.4 mm).
7. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.27, nominal.
8. Visible Light Transmittance (VLT): 51 percent, nominal.
9. Shading Coefficient: 0.27, nominal.
10. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
11. Visible Light Reflectance, Outside: 12 percent, nominal.
12. Blinds: Venetian, horizontal aluminum slats. Equal to BGB - Between Glass Blinds by Vista
    a. Color: To be selected from manufacturer's standard range..
    b. Controls: Manufacturer's standard. Shall be on the Corridor side.
        1) Removable key operator.

c. Functions: Manufacturer's standard.

E. Type 3 - Windborn Debris Impact Resistance Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
a. Tint: Clear.
b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, with .090 PVB, with Fully tempered float glass, 1/4 inch.
5. Total Thickness: 1 5/16 inch (____ mm).
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.27, nominal.
7. Visible Light Transmittance (VLT): 51 percent, nominal.
8. Shading Coefficient: 0.27, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
10. Visible Light Reflectance, Outside: 12 percent, nominal.

2.05 GLAZING UNITS

A. Type G-2 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass. Provide Heat Treated or Tempered safety glass as indicated on drawings and where required by code.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal. at panels less than 12 square feet. In units more than 12 square feet provide thickness of 5/16" or as recommended by manufacturer for size per ASTM C1048.

B. Type G-3 - Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
a. Glazed lites in doors, except fire doors.
b. Glazed sidelights to doors, except in fire-rated walls and partitions.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

C. Hurricane Impact Resistance Glazing: Laminated glass, 2-Ply.
1. Applications: Locations as indicated on drawings.
2. Tint: Clear.
3. Thickness: As required to meet performance criteria.
4. Outside Lite: Tempered glass.
5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
6. Inside Lite: Tempered glass.
7. Performance Criteria:
a. Hurricane Impact Resistance: Comply with ASTM E1996 windborne debris requirements for "Enhanced Protection" within Wind Zone 1.

2.06 GLAZING COMPOUNDS

A. Glazing Compounds: Glass: An elastic compound for glazing metal. Color to match frame finish.

B. Setting Blocks and Spacer Shims: Fabricate blocks and shims from neoprene shaped to the required size and thickness. The hardness for setting block and shim material shall be as recommended by the glass manufacturer.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

F. By beginning work, contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.05 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 80 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum sheathing.
F. Cementitious backing board.
G. Gypsum wallboard.
H. Joint treatment and accessories.
I. Plenum space sound control.
J. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.
B. Section 06 10 00 - Rough Carpentry: Building framing and sheathing.
C. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
D. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
E. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
F. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
G. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.
E. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
F. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
H. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.
I. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

M. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

N. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

O. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

P. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

Q. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2025.

R. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2025.

S. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

T. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.

U. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019 (Reapproved 2024).

V. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

W. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

X. UL (FRD) - Fire Resistance Directory; Current Edition.

Y. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
   2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches (300 by 300 mm) in size, indicating finish color and texture.

E. Steel Framing Industry Association (SFIA) Certification:
   1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
   2. Submit current documentation of contractor and fabricator accreditation. Keep copies of each on-site during and after installation, and present upon request.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Grid Suspension Systems: Provide grid suspension systems in accordance with ASTM C840 and GA-216 complying with the following:
   1. ICC-ES Evaluation Report No. _____.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Material and Product Requirements: AISI S201 and AISI S220.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

C. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. CEMCO; ____: www.cemcosteel.com/#sle.
   2. ClarkDietrich; ____: www.clarkdietrich.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

D. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50 (340), with G60 (Z180) hot-dip galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
   4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
   5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet (3660 mm).

F. Nonstructural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.

G. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
   1. Products:
      a. CertainTeed Corporation; ____: www.certainteed.com/ceilings-and-walls/#sle.
      b. USG Corporation; Drywall Suspension System: www.usg.com/#sle.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Georgia-Pacific Gypsum; ____: www.gpgypsum.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).

b. Ceilings: 5/8 inch (16 mm).

3. Glass Mat Faced Products:
   a. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com/#sle.
   b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Interior Extreme Fire-Shield Gypsum Panel: www.goldbondbuilding.com/#sle.
   c. USG Corporation; Sheetrock Brand Glass-Mat Panels Mold Tough Regular 1/2 in. (12.7 mm): www.usg.com/#sle.

C. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Fire-resistance-rated Type X, UL or WH listed.
4. Thickness: 5/8 inch (16 mm).
5. Edges: Tapered.
6. Glass Mat Faced Products:
   a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Interior Extreme AR Gypsum Panel: www.goldbondbuilding.com/#sle.
   b. USG Corporation; Sheetrock Brand Glass-Mat Panels Mold Tough AR Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.

D. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Fire-resistance-rated Type X, UL or WH listed.
4. Thickness: 5/8 inch (16 mm).
5. Edges: Tapered.
6. Glass-Mat-Faced Type: Noncombustible gypsum core with fiberglass face; comply with ASTM C1658/C1658M.

E. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas, including manufactured housing, tub and shower surrounds, and shower ceilings.
2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch (16 mm).
   b. Products:
      1) CertainTeed Corporation; 5/8" GlasRoc Tile Backer Type X: www.certainteed.com/#sle.
      2) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com/#sle.
      3) USG Corporation; Durock Brand Glass-Mat Tile Backerboard 5/8 in. (15.9 mm): www.usg.com/#sle.

F. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Edges: Square.

G. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (600 mm) wide, beveled long edges, ends square cut.
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
2. Glass Mat Faced Products:
   a. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant): www.gpgypsum.com/#sle.
   b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Shaftliner: www.goldbondbuilding.com/#sle.

c. USG Corporation; Sheetrock Brand Glass-Mat Liner Panels Mold Tough 1 in. (25.4 mm): www.usg.com/#sle.

2.04 GYPSUM BOARD ACCESSORIES

A. Water-Resistive Barrier: See Section 07 25 00.

B. Beads, Joint Accessories, and Other Trim: ASTM C1047; rigid plastic, galvanized steel, or rolled zinc.
   1. Corner Beads: Low profile, for 90 degree outside corners.
      a. Products:
         1) ClarkDietrich; Strait-Flex OS-300: www.clarkdietrich.com/#sle.
   2. L-Trim with Tear-Away Strip: Sized to fit 1/2-inch (13 mm) thick gypsum wallboard.
   3. Expansion Joints:
      a. Products:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Runners shall be securely anchored at 24 inches on center to concrete with power driven anchors, anchors to suspend ceilings shall be with toggle or mobility bolts. Anchors to structural steel shall be done with power drive anchors.

D. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
   4. Chase wall studs shall be a double row of studs positioned vertically in the runners so studs are opposite each other in pairs. Studs shall be spaced at maximum of 16 inches on center. Cross bracing between rows of studs shall be made of wallboard, 12 inch by chase width, screw attached to the end stud webs at quarter points in the partition height, with one-inch screws spaced 8 inches on center in each stud web.

E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

F. Corners: Shall be fabricated using a minimum of three studs.

G. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall-mounted door hardware.

7. Monitors
8. As indicated in documents

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.05 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.07 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION 09 21 16

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic accessories.

E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

C. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

D. Section 09 24 00 - Cement Plastering: Lath and Portland cement scratch coat where required by TCNA (HB) or TCNA (HB-GP) method specified.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

B. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

C. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

D. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

E. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2023.

F. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.

G. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.

H. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation; 1999 (Reaffirmed 2021).

I. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.

J. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

K. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

L. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

M. ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2017 (Reaffirmed 2022).

N. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).

O. ANSI A118.13 - American National Standard Specification for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation; 2014 (Reaffirmed 2024).

P. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.

Q. ANSI A136.1 - American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile; 2020.

R. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

S. ANSI A137.2 - American National Standard Specifications for Glass Tile; 2022.

T. ANSI A137.3/A108.19/A108.20 - American National Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs (Material and Installation Standards); 2025.

U. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.

V. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

W. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

X. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).

Y. ASTM C847 - Standard Specification for Metal Lath; 2018 (Reapproved 2024).

Z. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

AA. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

BB. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

CC. ASTM D2370 - Standard Test Method for Tensile Properties of Organic Coatings; 2016 (Reapproved 2021).

DD. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane; 2017 (Reapproved 2022).

EE. ASTM D4551 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane; 2022.

FF. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

GG. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine; 2025.

HH. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors; 2025.

II. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

JJ. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

KK. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

LL. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2021, with Editorial Revision (2022).

MM. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2025-2026.

NN. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

D. Samples: minimum 4 by 4 inches (_____ by _____ mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Installer's qualification statement.
1. Submit documentation of Natural Stone Institute Accreditation.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Tile: 5 percent of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Locate loose lay tile pattern for breakroom backsplash for tile layout variation approval..

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile:
1. Trinity Tile: www.trinitytile.com/
2. Acme Brick: www.brick.com/
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Setting Materials:
1. Custom Building Products: www.custombuildingproducts.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

C. Epoxy Grout:
1. LATICRETE International, Inc: www.laticrete.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Floor Tile: Provide tile for flooring applications with minimum wet Dynamic Coefficient of Friction (DCOF) of 0.42 when tested in accordance with ANSI A326.3.

2.03 TILE

A. Ceramic Mosaic Tile: ANSI A137.1 standard grade.
   1. Color: As indicated on drawings.
   2. Pattern: As indicated on drawings..
   3. Products:
      a. As indicated on drawings..
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Porcelain Tile, Type _____: ANSI A137.1 standard grade.
   1. Color: As indicated on drawings.
   2. Pattern: As indicated on drawings..
   3. Products:
      a. As indicated on drawings..
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: as indicated on drawings, style and dimensions as indicated on drawings, set with tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall and floor tile.
      b. Inside and outside wall corners.
      c. Transition between floor finishes of different heights.
      d. Thresholds at door openings.
      e. Borders and other trim as indicated on drawings.
   2. Products:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. As indicated on drawings..
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 SETTING MATERIALS

A. Cement Plaster and Lath: See Section 09 24 00.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Products:
      a. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
      b. _____.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
   1. Applications: Where indicated on drawings.
   2. Products:
      a. As indicated on drawings..

2.06 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Color: As indicated on drawings or as selected by Architect from manufacturer's full line.
   2. Products:
      a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.

1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
2. Fluid or Trowel Applied Type:
   a. Thickness: 20 mils (0.5 mm), maximum.
   b. Products:
      1) TEC Specialty Products LLC; TEC Crack Defense Pro Crack Isolation Membrane: www.tecspecialty.com/#sle.
      2) Substitutions: See Section 01 60 00 - Product Requirements.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16-inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Products:
         1) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

M. For CT-11 only, random installation mix, verify qty 7 in mix. Contractor to provide dry mockup for Interior Designer review and approval prior to installation.

3.04 CLEANING

A. Clean tile and grout surfaces upon completion, spange and wash tile thoroughly. Finally polish with clean dry cloths. Acid shall not be used to clean tile.

3.05 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation or as recoemnded by manufacturer.

END OF SECTION 09 30 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary insulation above ceiling.

D. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings

E. Include all design engineering and necessary support framing members for a complete installed system. Contractor shall coordinate supports with other trades as needed in order to meet these specifications including design for spans and deflection by a licensed engineer.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings..

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.
   3. Extra Exposed Suspension System Componenets. Quanitity equal to 2 percent of total amount installed.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. Unika Vaev, www.unikavaev.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Armstrong World Industries, Inc; ____: www.armstrongceilings.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Class A in accordance with ASTM E84.

2.03 ACOUSTICAL UNITS

A. Acoustical Panels, APC-1: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type A.
   2. Size: 24 by 24 inches (610 by 610 mm).
   3. Thickness: 7/8 inch (____ mm).
   4. Panel Edge: Tegular.
   5. Tile Edge: Beveled.
   6. Color: White.
   7. Suspension System, 15/16: Exposed grid.

B. Acoustical Panels, APC-2: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type A.
   2. Size: As indicated on Interiors Finish Legend.
   3. Thickness: 7/8 inch (____ mm).
   4. Installation: Mirror
   5. Color: As indicated on Interior Finish Legend.
   6. Suspension System: 15/16" Exposed Grid. Reference Interior Finish Legend.

C. Acoustical Panels, Type APC-3: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Classification: ASTM E1264 Type A.
   2. Size: 24 by 24 inches (610 by 610 mm).
   3. Thickness: 3/4 inch (19 mm).
   4. Panel Edge: Tegular.
   5. Tile Edge: Beveled.
   6. Color: White.
   7. Suspension System: Exposed grid.

2.04 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.

B. Exposed Suspension System, Type APC-1, APC-2 Hot-dip galvanized steel grid with steel cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch (24 mm) face width.
   3. Color: As Indicated on Finish Legend.

4. Products:
    a. Armstrong World Industries, Inc; Prelude XL: www.armstrongceilings.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Exposed Suspension System, Type APC-3: Hot-dip galvanized steel grid and cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch (24 mm) face width with integrated linear lighting solution with T-bar LED by JLC-TECH.
3. Color: As Indicated on Finish Legend.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Moldings: Same metal and finish as grid.

E. Metal Edge Trim for Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Finish: Baked enamel.
2. Color: White.
3. Products:
    a. Armstrong World Industries, Inc; AXIOM Classic: www.armstrongceilings.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.

C. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.05 CLEANING

A. Clean surfaces.

B. Replace damaged or abraded components.

END OF SECTION 09 51 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, 6 by 6 inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.

D. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile - Type LVT-1, LVT-2: Printed film type, with transparent or translucent wear layer.
   1. Manufacturers:
      a. Armstrong Flooring: www.armstrongflooring.com/#sle.
      b. Karndean Design Flooring: www.karndean.com/
      c. Mohawk Flooring: www.mohawkflooring.com
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
   3. Plank Tile Size: As indicated on Finish Legend.
   4. Wear Layer Thickness: As indicated on Finish Legend
   5. Total Thickness: As indicated on Finish Legend.
   6. Pattern: As indicated on Finish Legend.
   7. Color: As indicated on Finish Legend.

8.

2.02 RESILIENT BASE

A. Resilient Base - Type RB-1: ASTM F1861, Type TP, rubber, thermoplastic; style as scheduled.
   1. Manufacturers:
      a. Tarkett Flooring: www.tarkett.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Height: 6 inches (150 mm).
   3. Thickness: 1/8" inch (____ mm).
   4. Finish: As specified
   5. Length: Roll.
   6. Color: As indicated on drawings.

2.03 ACCESSORIES

A. Adhesive for Vinyl Flooring:
   1. Manufacturers:
      a. As recommended by maunfacturer.

B. Moldings, Transition and Edge Strips: Metal.
   1. Manufacturers:
      a. Mannington Commercial; _____: www.manningtoncommercial.com#sle.
      b. Schluter-Systems: www.schluter.com/#sle.
      c. Tarkett/Johnsonite. www.commerical.tarkett.com
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Products:
      a. As indicated on Finish Legend.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM D4263 - Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method; 2024.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

G. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit one samples, 3 by 6 inch (____by____ mm) in size illustrating color and pattern for each floor material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

E. Applicator's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.
   1. Minimum five years of documented experience.
   2. Approved by manufacturer.
   3. Approved Applicators:
      a. TW Hick; Tim Hicks - Phone (866) 841-3483; email: timtwhicksinc.com

C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

D. Field Quality Control:
   1. Installer shall request acceptance by Owner's Representative and Manufacturer Representative of each coat before applying succeeding coats.
   2. Furnish and maintain at Project site following fully calibrated testing and inspection devices:
      a. Wet Mil Gauge
      b. Tooke Destructive Mil Gauge.
      c. Sling Psychrometer.
   3. Initiate and maintain for duration of Project field quality control program using certified calibration and testing devices and to ensure conformance with application requirements.

E. Contractor shall test concrete moisture prior to installation in accordance with ASTM D4263

1.05 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
   1. Number of Mock-Ups to be Prepared: One.
   2. Use same materials and methods for use in the work.
   3. Use approved design samples as basis for mock-ups.
   4. Locate where directed. Area will be slected by Architect in non-conspicuous area such as Janitors Closet or Storage. Would be roughly 100 sqft.

C. Obtain approval of mock-up by Architect before proceeding with work.

D. Approved mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

D. Close space to traffic during resinous flooring application and not less than 24 hours after application, unless manufacturer recommends a longer period.

1.08 WARRANTY

A. Submit manufacturer's five-year warranty covering materials only.

B. Submit two-year warranty application warranty for installation and material replacement costs and shall cover delamination of flooring, and transfer of slab cracks through the epoxy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
   1. Sika Industrial Flooring: https://usa.sika.com/
   2. Products of the following conforming to the spection requirements are acceptable.
      a. Tennan
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring EFS-1, EFS-2: Urethane, two component, thermosetting, colored with mineral filler, with aggregate broadcast on base coat.
   1. As indicated on drawings
   2. Color:
      a. Provide colors as indicated on the drawings and as selected from manufacture standard palette. Additionally, custom colors and blends may be an option if indicated on drawings. Final colors to be selected and approved with the submittal.
   3. Base Coat:
      a. Sika; Sikafloor DecoDur Quartz-HDB: www.sika.com.

2.03 ACCESSORIES

A. Industrial Grease Remover: Manufacture’s recommended detergents to remove a variety of soilage prior to final completion.

B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows in accordance with ICRI 310.2R and SSPC-SP 13/NACE No.6:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Scrub subfloor with manufacturer’s detergent and rinse with clean water to remove surface dirt, grease and oil.

C. Shot-blast or mechanically abrade to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide surface profile. Large voids, bugholes, and other cavities should be filled with recommended filler or surface.

D. Prepare concrete surfaces according to ICRI 310.2R, CSP 3 or greater surface profile.

E. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

F. Vacuum clean substrate.

G. Apply primer to surfaces required by flooring manufacturer.

3.03 APPLICATION

A. Apply floor coating system in strict accordance with manufacturer’s latest published instructions. The following is intended as a general guide for minimum application. Final proportions and amounts may vary depending on the final color and texture approved by the Owner and Architect to achieve a light texture.

B. Equipment: Squeegees, rollers, mechanical blower and funnel for quartz application, etc.

C. Coating: Tnemec Deco-Tread (or approved ECO-DFS Decorative Floor Solution by Tennant)
   1. Mix components together in accordance with manufacturer’s instructions.
   2. Apply Tnemec Series 245 Ultra-Tread urethane cement applied at 3/16" thickness Allow coating to cure 12 hours at 75 degrees F (24 degrees C) and 50% relative humidity.
   3. Apply Tnemec Series 222 Deco-Tread at the rate of approximately 80 sq. ft./gal.
   4. Immediately broadcast Tnemec 222 Part C (ChromaQuartz) decorative quartz into the resin at the rate of one half (0.5) pounds per sq. ft.
   5. Allow coating to cure 12 hours at 75 degrees F (24 degrees C) and 50% relative humidity
   6. Sweep and then vacuum the entire area to remove all excess quartz.
   7. Apply second coat Tnemec Series 222 Deco-Tread at 80 ft2 / gal.
   8. Repeat steps above as required by manufacturer.

9. Apply a grout coat of Tnemec Series 256 Excellathane applied at 134 to 267 ft2 / gal.

D. Finish Coat: Tnemec 291 Series
   1. Mix components together in accordance with manufacturer's instructions.
   2. Mix only enough material, which can be applied within 10 minutes.
   3. Apply Tnemec 291 Series as recommended by manufacturer.
   4. Allow coating to dry 2 hours at 75 degrees F (24 degrees C) and 50% relative humidity.
   5. If less texture is desired, additional coats shall be applied within 72 hours of applying the previous coat, or as recommended by the manufacturer. Thickness of each coat and number of coats will determine the texture. Texture shall match approved mock up and no additional payment will be considered for additional coats to achieve acceptable texture.
   6. Total thickness of this system: 1/4-inch nominal thickness.
   7. Cove Base: Tnemec Series 222 Deco-Tread blended with Series 222 Part C (ChromaQuartz) to form a 6" rolled radius cove.

E. Cove Base: Tnemec Series 222 Deco-Tread blended with Series 222 Part C (ChromaQuartz) to form a 6" rolled radius cove.
   1. For all areas to receive cove base, install stainless steel J-Strip at the specified height to receive top edge of coving.

F. Seal all exposed perimeter joints along walls, storefront, and top of bases.

G. Comply with recommendations of product manufactured for dying time between succeeding coats.

H. All cracks must be identified as either moving or non-moving. All cracks 1/16" wide or greater must be routed-out into a V-shape and filled flush by using Series 206 Sub-Flex epoxy and primer, as required for the particular filling installations. Treat moving cracks as control joints as described under "Joints" below.

I. Make edges of coatings adjoining other materials clean and sharp with no overlapping. Work material into surface voids and hairline cracks.

J. Exposed Perimeters:
   1. All exposed perimeter edges of the broadcast overlay, including doorways, traffic aisle sides, drains, etc. must be saw cut. Areas that cannot be reached with the saw or are difficult to saw cut shall be chipped.
   2. Saw cut shall be a minimum of ¼" deep and ¼" wide.
   3. Prime saw cut areas with Tnemec Series 201 Epoxoprime.
   4. Install flooring so that it folds into saw cut.

K. Joints:
   1. Expansion Joints:
      a. Install flooring so that it covers the expansion joint.
      b. After the floor system is installed, honor existing expansion joint by saw cutting a new ¼" x ¼" joint over the existing. Install closed cell polyethylene backer rod into saw cut approximately ½" to ¾" down into expansion joint, as required.
      c. Fill saw cut with flexible polyurethane joint sealant designed for expansion joints.
   2. Control Joints:
      a. Fill all other recessed joints with Tnemec Series 201 Epoxoprime blended with fumed silica or Tnemec Series 215 Surfacing Epoxy. When filled, joint should be flush with the floor surface.

L. Rolled Radius Coving:
   1. Install coves prior to the installation of special flooring.
   2. Apply a prime coat of Tnemec Series 201 to all surfaces scheduled to receive coving.
   3. Install cove flush with the outer edge of the J-Strip.
   4. Apply coving sealant bead to top of J-Strip and tool flush to provide a smooth and uniform appearance, as indicated on the Drawings.
   5. Cut coves as required for joints.

M. Cove at vertical surfaces.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

C. Coordinate exact protection with Resinous floor manufacture to prevent damage to floor sealer and top coat.

3.05 SLIP RESISTANCE

A. Finished prodct shall meet all OHSA, TAS and ADA Standards slip resistant requiremnets. TAS slip resistance requires a static coefficient of friction for level surfaces of 0.6 minimum testing in accordance to ANSI B101.5.

END OF SECTION 09 67 00

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PART 2 PRODUCTS

1.01 MATERIALS

A. Tile Carpeting, Type _____: Tufted, manufactured in one color dye lot.

END OF SECTION 09 68 13

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall coverings.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Substrate preparation.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ASTM F793/F793M - Standard Classification of Wall Coverings and Ceiling Coverings by Use Characteristics; 2025.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 6 by 6 inches (152 by 152 mm) in size, illustrating color, finish, and texture.

E. Manufacturer's Instructions: Indicate installation special procedures.

F. Maintenance Materials: Furnish the following for Owner's use in project maintenance:
   1. See Section 01 60 00 - Product Requirements for additional provisions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials for damage upon arrival.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Maintain adhesive and wall covering manufacturer's recommended temperature ranges 24 hours before, during, and after installation.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. Manufacturers
   1. MDC Interior Solutions[<>]: www.mdcwall.com/#sle.
   2. Wolf-Gordon; RAMPART: www.wolfgordon.com/#sle.
   3. Takeform; www.takeform.net
   4. Substitutions: See Section 01 60 00-Product Requirements.

B. Wall Covering - VWC-1: Vinyl Wallcovering
   1. Comply with ASTM F793/F793M, Category V, Type II.
   2. Total Weight: 20 oz/sq yd (_____ g/sq m).
   3. Roll Width: 52\54 inches (_____ mm).
   4. Backing: Nonwoven, synthetic fabric.
   5. Color: Cloud.
   6. Pattern: As indicated on drawings.
   7. Pattern Match: Straight.

8. Use coordinating trim pieces, Reverse hang; align the visable horizontal line from block motif.

C. Wall Covering - Type VWC-2, VWC-3, VWC-4, VWC-5: Vinyl Wallcovering .
1. Texture: Linen CDP-513
2. Product: Digtial Rampart, Type III
3. Color: As indicated on drawings.
4. Pattern: Digital murals to be provided by Interior Design team.
5. Installation and Repeat: non reverse hang, random match.

2.02 SPECIALITY WALL TREATMENTS

A. Speciality Wall Finish (SWS-1)
1. Type: Slat Wall System
2. Content: High Pressure Laminate
3. Finish: As indicated on Interior Finish Legend
4. Inserts: 7000 Series Aluminum
5. Sizing: Verify with Architect and in field.
6. Maintence: Optional Aegis Anti-microbial spray to limit the spread of germs.
7. Manufacturers: Marlite: www.marlite.com
8. Accessories:
A. Item: 6285CZ Universal Double Sloping Basket (24"x10"x5")
B. Quanitity: 4 pieces
C. Color: Chrome
D. Manufacturer: Palay Display Industries
A1. Item: 6203CZ Universal Large Basket (8"x12"x12")
B1. Quanitity: 4 pieces
C1. Color: Chrome
D1. Manufacturer: Palay Display Industries
A2. Item: 2584Z Slatwall Shelf (12" x 24")
B2. Quanitity: 2 pieces
C2. Color: Chrome
D2. Manufacturer: Palay Display Industries
A3. Item: 2525 Slatwall Hook- 10"
B3. Quanitity: 1 pieces
C3. Color: Chrome
D2. Manufacturer: Palay Display Industries

2.03 ACCESSORIES

A. Adhesive: Type recommended by wall covering manufacturer.

B. Termination Trim: Extruded plastic, clear. Verify with designer prior to install.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are primed and meet manufacturer's requirements to receive work.

B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) or at rate greater than 1/16 inch/ft (5 mm/m).

D. Notify Architect of detrimental conditions affecting wall covering installation.

E. Correct detrimental conditions before starting installation.

3.02 PREPARATION

A. Remove wall plates and accessories impeding wall covering installation.

B. Substrate Priming and Preparation: See Section 09 91 23.
   1. Wall Surfaces: Clean,smooth and free from defects and imperfections as per maufacturers instalation and instructions. Moisture Content of wall will be checked with a moisture meter and installation will not proceed if the moisture content is above 7%.

C. Substrate Priming and Preparation:
   1. Fill cracks in substrate and correct irregularities with filler; sand smooth.
   2. For marks capable of bleeding through surface finishes, seal with shellac.
   3. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

D. Wash impervious surfaces with tetra-sodium phosphate; rinse and neutralize; wipe dry.

E. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing.

F. Correct surface defects affecting work of this section and clean surfaces. Remove existing coatings exhibiting loose surface defects.

G. Vacuum surfaces to remove loose particles.

H.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall immediately before applying wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.

E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Butt edges tightly.

G. Overlap adjacent panels as recommended by manufacturer.

H. Horizontal seams are not permitted.

I. Do not seam within 2 inches (51 mm) of internal corners or within 6 inches (152 mm) of external corners.

J. Cover spaces above and below windows and above doors in pattern sequence from roll.

K. Apply wall covering to electrical wall plates before replacing plates.

L. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches (152 mm) of wall covering termination. Ensure complete contact bond.

M. Install termination trim.

N. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.

O. Reinstall wall plates and accessories removed to accommodate work of this section.

3.04 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.05 PROTECTION

A. Protect installed products from damage until mm-dd-yyyy.

END OF SECTION 09 72 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic Coatings.

B. Acoustic Insulation Finishes.

C. Acoustic Wall Coverings.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for products specified.

C. Samples: Submit two samples 6 by 6 inch (____ by ____ mm) in size indicating colors for selection.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Maintenance Data: Provide manufacturer's data on maintenance and renewal of applied finishes.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing work of type specified in this section, and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Store and handle materials according to manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply acoustical finishes when surface and ambient temperatures are outside the temperature ranges required by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Wall Panel : AWP-1 (NOT USED)
   1. Manufacturer: N/A.
      a. 1). As indicated on Finish Legend.

B. Acoustic Wall Coverings: AWP-2
   1. Manufacturer: Unika Vaeve.
      a. 1). As indicated on Finish Legend.

2.02 ACOUSTIC WALL COVERINGS

A. General:

1. Provide materials compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 ACCESSORIES

A. Materials: Provide primers, sealers, cleaning agents, and clean up materials as required for completion of acoustic finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of acoustic finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from splatter and overspray.

B. Mask surface appurtenances including, but not limited to, exit signs, fire sprinkler escutcheons, HVAC grilles, light fixtures, and speaker grilles.

C. Replace damaged ceiling materials.

D. Prepare surfaces using cleaning methods recommended by the manufacturer.

E. Seal surfaces that may cause bleed through or staining of acoustic finish.

F. Seal surfaces that may cause bleed through or staining of wall covering.

3.03 APPLICATION

A. Apply in accordance with manufacturer's written instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Reinstall surface appurtenances removed prior to finishing.

E. Acoustic Wall Coverings:
   1. Apply premixed adhesive directly to wall.
   2. Cut material to desired length and along vertical edge of ribbed pattern. Install in vertical strips, edges butted.
   3. Apply wall covering smooth, without wrinkles, gaps, or overlaps. Eliminate air pockets, and ensure full bond to substrate surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.05 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

C. Remove masking and covering and residue left from masking.

3.06 PROTECTION

A. Protect finishes from subsequent construction operations.

B. Touch-up damaged finishes.

END OF SECTION 09 83 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Interior painting and coating systems.

C. Exterior painting and coating systems.

D. Scope:
   1. Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
      a. Exterior:
         1) Concrete: Cementitious siding, Flexboard, Transite, non-roof shingles, common brick, stucco, tilt-up, precast, and poured-in-place cement.
         2) Metal: Aluminum, galvanized.
         3) Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, ferrous metal.
      b. Interior:
         1) Concrete, Walls and Ceilings: Poured concrete, precast concrete, unglazed brick, cement board, tilt-up, cast-in-place concrete, and plaster.
         2) Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
         3) Metal: Aluminum and galvanized.
         4) Metal, Galvanized: Ceilings and ductwork.
         5) Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
         6) Wood: Walls, ceilings, doors, and trim.
         7) Drywall: Walls, ceilings, gypsum board, and similar items.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealant.

B. Section 092000 - Gypsum Wallboard, Metal Frame Systems

C. Division 23 - Mechanical

D. Division 26 - Electrical

1.03 REFERENCE STANDARDS

A. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

B. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

C. SSPC-SP 7/NACE No.4 - Brush-Off Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.

C. Samples: Submit four paper draw down samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

C. Paint Materials: Store at a minimum of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.

B. Follow manufacturer's recommended procedures for producing the best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Subject to compliance with requirements, provide Sherwin-Williams Company (The) products indicated; www.sherwin-williams.com/#sle.

B. Comparable Products: Products of approved manufacturers will be considered in accordance with 01 60 00 - Product Requirements, and the following:
   1. Products are approved by manufacturer in writing for application specified.
   2. Products that meet or exceed performance and physical characteristics of basis of design products.
   3. Other Acceptable Manufacturers:
      a. PPG.
      b. Benjamin Moore.

2.02 PAINTINGS AND COATINGS

A. General:
   1. Provide factory-mixed coatings unless otherwise indicated.
   2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

B. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

2.03 PAINT SYSTEMS - EXTERIOR

A. Concrete: Cementitious siding, Flexboard, Transite, non-roof shingles, common brick, stucco, tilt-up, precast, and poured-in-place cement.
   1. Latex Systems:
      a. Semi-Gloss Finish:
         1) 1st Coat: Sherwin-Williams Loxon Concrete and Masonry Primer Sealer LX02W50: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA High Performance Acylic Semi-Glass, B66-350 Series: www.sherwin-williams.com/#sle.
   2. Elastomeric System: Not including cementitious siding, Flexboard, Transite board or non-roof shingles.
      a. Flat Finish:

1) 1st Coat: Sherwin-Williams Loxon BlockSurfacer, A24W00200.
2) 2nd and 3rd Coat: Sherwin-Williams Conflex XL Elastomeric Masonry Coating, CF16W50 Series: www.sherwin-williams.com/#sle.

3. Textured and Smooth Systems (Texture as indicated on drawings):
   a. Textured Finish, Water Based:
      1) 1st Coat: Sherwin-Williams Loxon Concrete and Masonry Primer Sealer LX02W50: www.sherwin-williams.com/#sle.
      2) 2nd Coat: Sherwin-Williams Conflex UltraCrete Acrylic Textured Coating, CF17- Series: www.sherwin-williams.com/#sle.
         (a) Textured Finish: Fine.

B. Metal: Aluminum, galvanized.
   1. Latex Systems:
      a. Semi-Gloss Finish:
         1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA High Performance Acrylic Semi-Gloss, B66-350 Series: www.sherwin-williams.com
         3) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: www.sherwin-williams.com/#sle.

C. Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, ferrous metal, and hollow metal doors.
   1. Latex Systems:
      a. Semi-Gloss Finish:
         1) 1st Coat: Sherwin-Williams Pro-Cryl Uni, B66-1300 Series: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA High Performance Acrylic Semi-Gloss, B66-350: www.sherwin-williams.com/#sle.

2.04 PAINT SYSTEMS - INTERIOR

A. Concrete, Walls and Ceilings: Poured concrete, precast concrete, unglazed brick, cement board, tilt-up, cast-in-place concrete, and plaster.
   1. Latex Systems:
      a. Semi-Gloss Finish High Performance (HP):
         1) 1st Coat: Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50 Series: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA High Performance Acrylic Semi-Gloss, B66-350 Series: www.sherwin-williams.com/#sle.
   2. Epoxy Systems, Water Based:
      a. Eg-Shel/Low Luster Finish:
         1) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Water Based Catalyzed Epoxy, B73-361 Series: www.sherwin-williams.com/#sle.

B. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
   1. Epoxy Systems, Water Based (non-wet areas)
      a. Egg-Shell/Low Luster Finish:
         1) (CMU) 1st Coat: Sherwin-Williams Pro Industrial Heavy Duty Block Filler, B42W00150 : www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel, K45-2150 Series: www.sherwin-williams.com/#sle.

C. Metal: Aluminum and galvanized.
   1. Latex Systems:
      a. Semi-Gloss High Performance:

1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA High Performance Acrylic Semi-Gloss, B66-350 Series: www.sherwin-williams.com/#sle.

D. Metal, Galvanized: Ceilings and ductwork.
1. Dryfall Waterborne Topcoats:
a. Flat Finish:
1) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall Flat, BB42W02181 Series: www.sherwin-williams.com/#sle.

E. Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, hollow metal doors and ferrous metal.
1. Latex Systems:
a. Semi-Gloss High Performance:
1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA High Performance Acrylic Semi-Glass, B66-350 Series: www.sherwin-williams.com/#sle.
2. Dryfall Waterborne Topcoat - Finish all exposed metal deck and all roof structural framing:
a. Flat Finish:
1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall Flat, B42W02181 Series: www.sherwin-williams.com/#sle.

F. Wood: Walls, ceilings, doors, and trim. (For exposed deck and wood beams provide a stain and Wood Life sealer by deck and beam manufacture in lieu of urethane to accommodate movement without cracking.
1. Stain and Varnish System:
a. Satin Finish:
1) 1st Coat: Sherwin-Williams Minwax Performance Series Tintable Wood Stain 250 VOC: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Minwax Waterbased Oil-Modified Polyurethane: www.sherwin-williams.com/#sle.

G. Drywall: Walls, ceilings, gypsum board, and similar items.
1. Latex Systems:
a. Egg-Shell Finish:
1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W12600: www.sherwin-williams.com/#sle.
2) For areas indicated as level 5 finish: 1st Coat: Sherwin-Williams Builders Solution Interior Latex Primer-Surfacer, A63W00100: www.sherwin-williams.com
3) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Eg-Shel, B20-Series: www.sherwin-williams.com/#sle.
b. Flat Finish: (Ceiling finish)
1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W12600: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Flat, B30-Series: www.sherwin-williams.com/#sle.
2. Epoxy Systems, Water Based (Where indicated on drawings):
a. Egg-Shell/Low Luster Finish:
1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W12600: www.sherwin-williams.com/#sle.
2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Catalyzed Epoxy, B73-360 Series: www.sherwin-williams.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk.
   2. Fill bug holes, air pockets, and other voids with cement patching compound.

D. Masonry: Remove efflorescence and chalk.

E. Cementitious Siding: Remove dirt, dust and other foreign matter. Pressure clean, if needed, to remove grease, oil, and loose particles.

F. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.

G. Aluminum: Remove surface contamination and oil; wash with solvent according to SSPC-SP 1.

H. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1. Apply a test area, priming as required. Allow the coating to dry at least one week before testing.
   2. If adhesion is poor, Brush Blast per SSPC-SP 7/NACE No.4 to remove treatments. Test surfaces with Passivator Test Kit to ensure the surface is ready for paint.

I. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

J. Wood: Remove dust, grit, and foreign matter. Scrape, sand, and spot prime knots and pitch streaks. Fill nail holes and imperfections with wood filler and sand smooth.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.

3.04 PRIMING

A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to top coat manufacturers.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 90 00

PART 2 PRODUCTS

1.01 PLAQUES

END OF SECTION 10 14 16

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PART 2 PRODUCTS

1.01 DIMENSIONAL LETTERS

1.02 ACCESSORIES

END OF SECTION 10 14 19

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom printed self-adhesive wall covering.

1.02 RELATED SECTIONS

A. Division 1: Administrative, procedural and temporary work requirements.

1.03 REFERENCE STANDARDS

A. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2023.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Panel schedule in manufacturer's format for verification of graphic image and copy.

C. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
   2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
      a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
      b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
      c. Submit for approval by Owner through Architect prior to fabrication.

D. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.

E. Verification Samples: Submit samples showing colors, materials, and finishes specified.

F. Manufacturer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.Obtain from one source and a single manufacturer.

1.06 WARRENTY

A. Provide manufacturer’s warranty against defects in materials and workmanship for minimum 5 years.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signage Wallcovering:
   1. FASTSIGNS International, Inc; ____: www.fastsigns.com/#sle.
   2. Takeform: www.takeform.net/#sle.
   3. Red Elephant Design + Architectural Signage.www.redelephantway.com/#sle

4. Substitutions: Bidder must obtain prior written approval from the Architect and/or Owner to bid alternates or substitutions to the specification. Any request for substitutions must be accompanied by a listing of the specific points of deviation.

2.02 PANEL SIGNAGE WALLCOVERING

A. Panel Signage Wallcovering Type VWC-2, VWC-3, VWC-4. VWC-5:
   1. Sign Size: Refer to drawings.
   2. Color and Font, unless otherwise indicated:
      a. Character Font: Refer to drawings.
      b. Character Case: Refer to drawings.
      c. Background Color: Refer to drawings.
      d. Character Color: Refer to drawings.
   3. Wallcovering shall be self-adhesive intended for indoor or outdoor use on smooth or textured surfaces.
   4. Material:
      a. Wall covering shall be vinyl with a protective overlam included, coated on one side with a removable and repositionable acrylic pressure sensitive adhesive. Wall covering shall have a thickness of 4 mil.
      b. Wall covering shall be printed with UV or latex ink.
      c. Wall covering shall have a Type II classification.
      d. Wall covering shall resist mild alkalis, mild acids, salt and water.
      e. Wall covering shall be cleanable using mild dish soap and water.

PART 3 EXECUTION

3.01 SITE VISITS

A. Site visits – 3 site visits shall be required by the sign contractor:

B. Prior to submission of bid for site assessment and evaluation.

C. Post award for the purposes of meeting with Owners and project manager.

D. Final walk-through and punchlist.

3.02 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

C. Installer shall examine panels for defects, damage and compliance with specifications. Installation shall not proceed until unsatisfactory conditions are corrected.

3.03 DELIVERY, STORAGE, PROTECTION

A. Package to prevent damage or deterioration during shipment, handling, storage and installation. Products should remain in original packaging until removal is necessary. Store products in a dry, indoor location.

3.04 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Wallcovering shall have a 1/2" overlap.

D. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

END OF SECTION 10 14 23

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

C. Protective wall panels.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2024.

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit one sections of corner guards, 6 inches (_____ mm) long.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide IPC limited lifetime warranty against material and manufacturer defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
   1. Inpro Corporation; Corner Guards - Surface Mounted: www.inprocorp.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Protective Wall Panels:
   1. Koroseal Interior Products;: www.koroseal.com/#sle
   2. Panolam Industries International, Inc: www.panolam.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted (CG-1):
   1. Corner guards fabricated from rolled section or bent plate are specified in Section 05 50 00.
   2. Material: High impact vinyl
   3. Thickness: 0.070 inches
   4. Width of Wings: 2 inches (51 mm).
   5. Corner: Bullnose.
   6. Color: Feather 0238
   7. Length: One piece, 8 feet
   8. Mounting: Countersunk screws through factory-drilled holes.
   9. Preformed end caps.

B. Wall Protective Sheet (WPS-1)
   1. Material: uPVC
   2. Thickness: 0.040 inch (1.02 mm).
   3. Color: Feather 0238
   4. Collection: Palladium Rigid Sheet
   5. Size: 4 by 8 feet.

C. Protective Wall Panels: (FRP-1)
   1. Material: Fiberglass Reinforced Plastic:
   2. Thickness: 0.90 inches
   3. Panel Size: 4 feet by 8 feet (1220 mm by 2440 mm).
   4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 55 or less, when tested in accordance with ASTM E84.
   5. Color and Pattern: White
   6. Texture: Standard Peblette Texture
      a. Texture Direction: Horizontal.
   7. Mounting: Adhesive.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches (102 mm) above finished floor to 8 foot 4 inches high (____ mm high).

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.04 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

3.05 SCHEDULE

END OF SECTION 10 26 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Under-lavatory pipe supply covers.

D. Diaper changing stations.

1.02 RELATED REQUIREMENTS

A. Section 09 30 00 - Tiling: Ceramic washroom accessories.

B. Section 10 21 13.19 - Plastic Toilet Compartments.

C. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

G. ASTM C1036 - Standard Specification for Flat Glass; 2025.

H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

I. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

K. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

L. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.
2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.02 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.03 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted, for cored or coreless type rolls. Spindle must be free to rotate.
1. Product:
a. American Specialties, Inc. Model No. 0715. Size to accommodate two separate rolls of core type tissue to 5” diameter.
b. **Owner specified**; No substitutions allowed. Contractor to confirm with owner prior to order.

B. Combination Towel Dispenser/Waste Receptacle: Recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, ____.
1. Waste receptacle shall have max projection of 4".
2. Waste receptacle liner: Reusable, heavy-duty vinyl.
3. Towel dispenser capacity: 400 C-fold.
4. Waste receptacle capacity: 4 gallons (15 liters).
5. Products:
a. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
b. Bobrick, B-3944.

C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
1. Minimum Capacity: 48 ounces (1.5 liters).

D. Air Freshener Dispenser: Wall-mounted, battery operated.Mist deodorizer shall include LCD screen that displays battery life and days to refill. Mount at 80” to bottom.
1. Products:
a. Technical Concepts AutoFresh LCD Aerosol; TC400979BUND.
b. Rubbermaid Microburst 9000 Aerosol LCD Dispenser.
c. Substitutions: Section 01 60 00 - Product Requirements.

E. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
1. Shall have integrated LED lights on each side.
2. Mount bottom of Reflective surface at 40" above finish floor.
3. Size: 24 inches by 36 inches.
4. Products:
a. Equal to Bobrick B-169 series.
b. Substitutions: Section 01 60 00 - Product Requirements.

F. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:

a. Push and Pull Point Load: Minimum 250 lbf (1112 N).
b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: As indicated on drawings.

2.04 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for concealed mounting.

B. Shower Curtain:
1. Material: Polyester, machine washable, and mildew-resistant.
2. Size: 80 x 72 inches (____ mm), hemmed edges.
3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
4. Shower Curtain Hooks: Stainless steel spring wire designed for snap closure.

C. Wall-Mounted Soap Dish: Heavy duty, seamless stainless steel, surface-mounted with drain holes, without grab bar, satin finish; with concealed mechanical fastening suitable for substrate and backplate.
1. Products:
a. American Specialties, Inc; Soap Dish 7320-S.

D. Towel Pin: Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.

E. Robe Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Specified in 22 40 00 - Plumbing Fixtures.

B. Under-Lavatory Pipe and Supply Covers:
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch (3.2 mm) flexible PVC.
a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
b. Comply with ASTM C1822, type indicated.
c. Comply with ASME A112.18.9.
d. Comply with ICC A117.1.
e. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
6. Products:
a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.
b. Plumberex Specialty Products, Inc; Plumberex Trap Gear: www.plumberex.com/#sle.

2.06 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Polyethylene.
2. Mounting: Surface.
3. Color: Gray.

4. Minimum Rated Load: 250 pounds (113.4 kg).
5. Products:
   a. Saniflow Hand Dryer Corporation; Babymedi Horizontal: www.saniflowcorp.com/#sle.
   b. Sova by Foundations; Origin Horizontal Recessed Changing Station with Flange: www.choosesova.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 28 00

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

B. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2012 (Reapproved 2020).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.02 SUMMARY

A. Section Includes: T-Grooved wood composite 3/4” (19mm) thick panels, pre-engineered and machined for use with groove inserts and retail display hardware..
   1. Attachment System:
      a. Direct fastening of slatwall to metal stud framing.
   2. Panels:
      a. Faux Print finish (Simulated Wood Grain) applied by offset gravure print process utilizing solid color oven-baked base paints, ink overprints and oven-baked protective topcoat.
      b. Azure (Wood Grain) and Graphic Images applied using direct digital imaging to wood fiber substrate including seal coats, color inks and protective topcoats.
      c. Wood veneer laminated to wood fiber substrate having a balancing backer sheet, with protective topcoats.
      d. High Pressure Laminate adhered to wood fiber substrate and having a balancing backer sheet.

B. Products Not Furnished or Installed under This Section:
   1. Wood Veneer casework.
   2. Gypsum board backup.

1.03 RELATED SECTIONS

A. Section ____ - Wood Metal Stud Framing

B. Section ____ - Custom Cabinets

C. Section ____ - Solid Wood Paneling

D. Section ____ - Gypsum Wallboard.

E. Section ____ - Painting & Transparent Finishes.

F. Section ____ - Resilient Base.

1.04 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Architectural Woodwork Standards as published by the Architectural Woodwork Institute, the Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
   1. Architectural Woodwork Standards - Edition 1.

1.05 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer's standard color and pattern selection samples representing manufacturer's full range of available colors and patterns.
   1. Provide samples of edge trim as applicable.
   2. Provide samples for groove insert selection as applicable.

D. Samples for Verification: Submit sample for each component and for each exposed finish required, prepared on samples of size indicated below complete with exposed molding and trim samples. Sample to indicate type, finish, and color specified.
   1. Laminate and printed finishes: Submit 6" (154mm) by 10" (254mm) section of panel for each panel selected indicating the color, texture, and pattern required.
      a. Submit complete with specified applied finish.
      b. For selected patterns show complete pattern repeat.
   2. Painted finishes: Submit 6" (154mm) by 10" (254mm) samples of each type and color.
   3. Wood Veneers: Submit sample sets of each wood veneer with stain color and finish required. Sample size approximately 6" (154mm) by 10" (254mm). Sample sets to show the full range of normal color and texture variations expected.
   4. Mirrored Acrylic: Submit 6" (154mm) by 10" (254mm) sample.

E. Manufacturers Material Safety Data Sheets (MSDS) for panels, adhesives prior to their delivery to the site.

F. Maintenance Instructions.

1.06 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
   1. ASTM E84 (Method of test for surface burning characteristics of building Materials)
   2. Required Rating – Class A.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver panels and associated materials factory packaged on strong pallets and properly packaged or protected.
   1. Upon delivery carefully inspect all cartons, packages, pallets and protective wrap for damage or material shortage.
   2. Open and inspect suspect packages, cartons or wrapped pallets for damage.
   3. Contact shipper immediately to report any damaged or missing materials.
   4. Contact Marlite @ (800) 377-1221 immediately to report any damaged or missing materials.
   5. Contact Marlite @ (800) 377-1221 with any questions, problems or concerns.

B. Store products in manufacturer's unopened packaging until ready for installation.
   1. Maintain plastic or other protective wrap in place during on site handling until ready for installation.
   2. Keep panels clean and do not stack panels after removal of protection.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Wood composite panels are subject to the effects of humidity and temperature. Do not use in kitchens, rest rooms, or other high humidity areas.

B. Partition walls are to be finished and the building completely closed. Walls shall be thoroughly dry and concrete cured and dry before starting installation.

C. HVAC system must be operable and installation area must be balanced to normal operating conditions.

D. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. To ensure product performance, a

temperature range of 60°-80°F (16°C-27°C) and a humidity range of 35-55% must be maintained during storage, installation and product life cycle. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 COORDINATION AND SEQUENCING

A. Except as specified by the architect, it's recommended to locate trim members so that panel lines coordinate with doors, headers, jambs and other discontinuities in a wall.

B. Vapor barrier shall be used on exterior walls behind backing to discourage warping.

C. Coordinate with casework manufacturer. Deliver material to the fabrication shop.

1.10 WARRANTY

A. Standard Warranty: All products shall be warranted to be free from defects for a period of 30 days after installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCT

A. Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com.

B. Marlite Slatwall Panel

2.02 PANEL

A. Panel Configuration: Engineered groove machined into wood composite substrate.
   1. Panel thickness – 3/4" (19mm) thick with nominal1/2" (13mm) deep slotted grove.
   2. Panel face dimensions: 48" (1.22m) by 96" (2.44m).
      a. Dimensions: Nominal 24" (600mm) high x 24" (600mm).
   3. Slatwall panels grooves machined on 3" (76mm) centers as indicated on the drawings.

B. High internal bond wood composite substrate. Slatwall panels shall have formaldehyde emissions of 0.3 PPM or less and shall comply with HUD 24 CFR Part 3280 Standards set fourth for particleboard panels.
   1. Standard Slatwall
      a. Medium density wood fiberboard conforming to ANSI A208.2, industrial-grade MDF or other wood fiber substrates having not less than 75% recycled wood waste.
   2. Slatwall EQ
      a. High pine particleboard, industrial grade. NAF (No-Added Formaldehyde). 100% post-industrial recycled/recovered content. CARB exempt. Physical properties tested using method ASTM D1037-06
   3. Standard Slatwall, NAF
      a. Medium density wood fiberboard conforming to ANSI A208.2, industrial-grade MDF and having No-Added Formaldehyde (NAF).

2.03 PANEL FINISH

A. Painted Finishes:
   1. Standard Factory Finish: As selected by Architect from manufacturer's standard selection.
   2. Paint Grade: Smooth unfinished surface suitable for field or in-shop finishing.
   3. Primed Finish: Alkyd primer factory applied and baked creating a suitable surface for field finish in one coat.

B. Groove Treatment:
   1. Marlite 7000 Series: Factory installed aluminum insert – mill finished.

C. Panel Trim:
   1. Outside/Inside Corner – Marlite A760 1" x 1 " x 8'- 0" (2.4m) aluminum mill finish[Marlite P760 1-3/8" x 1-3/8" x 8'- 0" (2.4m) aluminum [white][Gray] finish]
   2. Edge – Marlite A770 1/2" x 3⁄4" x 8'- 0" (2.4m) aluminum mill finish

2.04 INSTALLATION ACCESSORIES

A. Phillips, bugle head, coarse threaded screws.

B. Marlite Rail Assembly: Combination of Mounting Track and Panel Bar
   1. Steel prefinished at the factory. Silver Powder Coat
   2. P770 Edge – D100White

C. Adhesives:
   1. Marlite Brand SS5262 Heavy Duty C-109 solvent based adhesive unless otherwise approved by Marlite.

2.05 FABRICATION

A. All framing, panels, hardware and accessories shall be factory finished and ready to install except for field fabrication required by perimeter and corner conditions.

B. Refinish field cut panel edges in accordance with manufacturer's instruction before installation.

C. Fabrication Tolerances for panels:
   1. Dimensional: □ 0.0625"
   2. Square: □ 0.125" across diagonals
   3. Thickness: □ 0.008"
   4. Grooving:: □ 0.031" (groove width and spacing between grooves)

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer's Examination: Examine conditions under which construction activities of this section are to be performed. Submit written notification to Architect and system manufacturer if such conditions are unacceptable. Beginning erection constitutes installer's acceptance of conditions.
   1. Verify that a vapor barrier has been provided on exterior walls behind backing to prevent warping.
   2. Verify backing panels are smooth, solid, and flat. All drywall joints are to be taped and finished.
   3. Verify that walls are primed before installation begins.
   4. Verify mechanical, electrical, and building service and/or items affecting work of this section are placed and ready to receive this work.
   5. Verify that stud spacing does not exceed 24" (600mm) on-center.

B. Structural walls are to be finished, with building completely closed. Walls shall be thoroughly dry before starting installation.

3.02 PREPARATION

A. Conditioning: Panels must be allowed to acclimate to a balanced environment in the installation location for 72 hours prior to installation.

B. Protect existing surfaces with drop cloths.

C. Except as directed by the architectural drawings, before installing, examine panels and arrange to achieve best combination of color, pattern, texture and grain.

3.03 INSTALLATION

A. Install all materials in strict accordance with the manufacturer's installation instructions with hardware straight, plumb, and level.
   1. Anchor units rigidly and securely in place.
   2. Cut sheets to meet existing supports.

B. Fasten initial bottom panel to the wall with #6 or #7 bugle head drywall screws. Install a minimum of one screw every third slot (or 9" (228mm)) vertically and every stud horizontally, typically every 16" (40.64cm) on centers horizontally (maximum 24" (600mm) on centers horizontally). Each 4' x 8' panel shall have minimum of 42 screws secured to studs or furring.

1. Where screws do not hit the studs, fasten with adhesive in accordance with the manufacturer’s recommendations.
2. Screws must be installed thru the panel grooves.
3. Slatwall panels without inserts do not require pre-drilling.
4. Slatwall panels with inserts require 5/32" pre-drilling of holes thru the insert and panel before fastening.

C. Avoid contamination of the panel faces with adhesives, solvents or cleaners during installation.

3.04 CLEANING AND PROTECTION

A. Clean and remove dust and other foreign matter from panel and framing surfaces. Clean finishes in accordance with manufacturer's instructions.

END OF SECTION 10 56 16

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric canopies.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings, anchor bolts.

B. Section 09 91 13 - Exterior Painting: Paint finish on framing members.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fabric covering, color fastness, stitching and seaming methods, attachment devices to framing system.

C. Shop Drawings: Indicate canopy layout, sizes, connection attachments, anchorage, size and type of fasteners, graphic images, patterns, and accessories.

D. Samples, Covering: Submit 12 by 12 inch (300 by 300 mm) sample of covering with representative hem stitch detail, seam with reinforcement, and attachment devices to framing system.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Executed warranty.

H. Specimen warranty.

1.05 QUALITY ASSURANCE

A. Canopy shall be designed to comply with state and local building codes

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 10 years of _____ experience.

C. Installer Qualifications: The installation of the canopy shall be performed by the manufacturer to assure single source responsibility.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Fabric: One year.
   2. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fabric Canopies:
   1. ShadeFX; _____: www.shadefxcanopies.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

2.03 FABRIC COVERINGS

A. Covering Materials: Comply with applicable code for fire resistance ratings for roof covering.
   1. PVDF Coated Polyester: 14.45 oz/sq yd (490 gm/sq m), resistant to ultraviolet light, mildew and water, flame resistant treated; _____ color as selected.
   2. Covering Attachment:

2.04 FABRICATION - FRAMING

A. Fit and shop assemble components in largest practical sizes for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

2.05 FABRICATION - COVERING

A. Manufacture covering in one piece wherever possible, sized and configured to suit framing.

PART 3 EXECUTION

3.01 INSTALLATION - FRAMING

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Erect canopy framing after concrete and masonry work in the vicinity is completed and washed down.

3.02 INSTALLATION - FABRIC COVERING

A. Install covering over framing members, stretched taut without creases or folds.

B. Attach covering and fasten securely.

C. Erect canopy fabric after concrete and masonry work in the vicinity is completed and washed down.

END OF SECTION 10 73 16.23

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of animal enclosures are indicated on drawings.

1.03 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages that must be built into other work for installation of animal enclosures and related work; coordinate delivery with other work to avoid delay.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and erection of animal enclosure assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work. Provide full scale sample door assembly for approval to be returned or incorporated into project upon approval.

C. Mock-up: If required by Owner or Architect during the submittal process, provide full size mock up for review on the job site prior to fabrication for each type Kennel with resting bench, mobile cage, guillotine door, pass thru door (both installed in a masonry wall), and a cat enrichment box
   1. WARRANTY
      a. Provide non prorated, no deductible, full-coverage warranty against material and labor for all animal equipment items including latch assemblies and all items listed in this specification section, for a length of three years from date of substantial completion.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Products specified are by:
   1. MidMark/ShorLine, Schroer Manufacturing Company, 511 Osage, Kansas City, KS, 66105. 1-800-444-1570, Fax 1-913-281-5339 and are listed as a standard of quality. Contact Mark Shea - mshea@midmark.com
   2. Tri Star Vet / Direct Animal Products, 554 S. Allen St, Boyd, TX 76023. 1-877-459-7827 ext 23, Fax 1-940-433-5469 and are listed as a standard of quality. Contact Tim Nichols - mshea@midmark.com

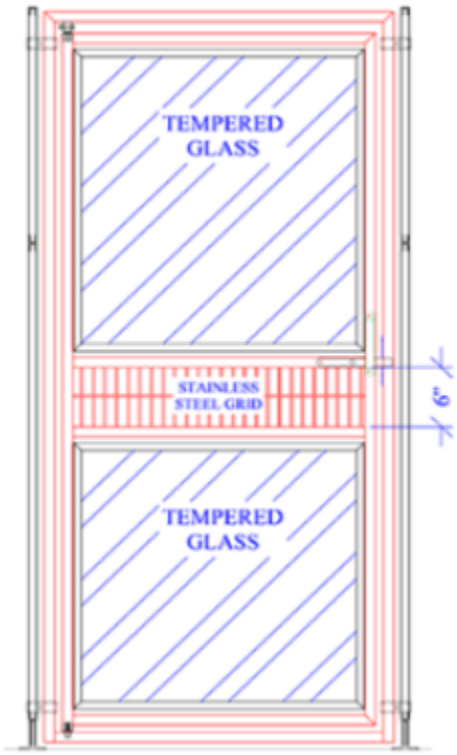
B. Products of MidMark/ShorLine, Tri Star Vet, Suburban Surgical and LGL Animal Care Products, Inc. conforming to the specifications are acceptable. Note that all indoor kennel assemblies shall be provided by one manufacture. All outdoor kennel assemblies shall be provided by one manufacture. All cage bank assemblies shall be provided by one manufacture.

C. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS

A. Gates / Gate Frame: Gate frame and gate panel constructed of welded 1 1/4", 18ga, or 1",16ga, 304 stainless-steel tubing including horizontal tube at gate, and 1/4" 304 stainless-steel rods equally spaced at 4"oc max. with 1/8" vertical bars at 1" oc max. all welded intersections. Cross members shall include 18ga 304 stainless-steel tubing at midpoint with min

six (6) stainless-steel supports to support the vertical rods. Provide standard 30” wide gate frame assembly with adjacent side panels to match gate to accommodate total width indicated on plans. Gate and panel assemblies shall have a total height of 78”. Include stainless-steel rotating food bowl in door (1-6qt. pail and 1-2qt. bowl per door), plus 50% additional bowls for cleaning and extra stock. Provide 30” wide gate frame, full grill gate & adjacent panel. Include automatic self-latching dual pin stainless-steel latch to allow operation from inside, 14-gauge stainless-steel hardware with 11-gauge latch bar, and nylon bushings on latch for quiet secure operation requiring no lubrication. Provide additional hole in bottom of latch to allow supplemental locking. Include 30” High Stainless-steel Panel with Grill Above on Gate and Panel for all Rooms.



B. Side Panels: Provide side panel installation on top of CMU partition wall, refer to drawings/wall types for CMU partition height. Rain glass/tempered glass side panels to all panels in typical to all panels to be located at Kennel Rooms 118, 119, 120, 121, 136, & 137. One 20-gauge, 304 stainless-steel panel on each side of the square frame. Panels to be -constructed to finish from of CMU wall to top of kennel equal to 78"h varies with mfg. ”. All stainless-steel mounted hardware/anchors required. No rivets or exposed screws on side and front panels – must use concealed fastening method.

C. Top Panels needed as indicated on drawings. All Kennel Tops Manufactured with Stainless-steel 16-gauge 304 series Stainless-steel Frame with 3/16”, 7-gauge wire in a 4”x4” pattern, all stainless-steel hardware for mounting top panels required.

D. Guillotine doors at each indoor / outdoor kennel as indicated on drawings: Surface mount guillotine door constructed of .400 HDPE that will slide vertically in two (2) stainless steel tracks, with two (2) cable pulleys; hook and cable with counterbalance system – pre-weighted counterbalance located on kennel door face. Cable to be concealed internally and should have a protective wrap at the end where it is cut and looped on the door and counterbalance weight. Provide locking mechanism to prevent animals from lifting door and provide stop angle at

bottom of door to prevent sliding past opening. Min clear opening shall be 16"w x 24"h – coordinate actual opening and door size required.

E. Pass Through Pet Door: Equal to PlexiDor Pet Door - bi-swing door. Surface mountedExtra-Large (PD Wall XL SV) door measuring 18"w x 25"h with a 16" x 24" clear opening. Doors manufactured out of heavy-duty aluminum frame, clear shatter-resistant 3/8" thick composite acrylic doors that resist damage from sunlight, extreme temperature, ad high impact. Stay-open hinges stay open for training and include keyed lock for security. Designed to open and close quietly to mininize dog stress.
   1. Mock-up door to be provided/installed in the masonry mock-up wall panel.
   2. Contact: PDUSA, Inc. - Deidre Ambrose. Ph: 941-752-7021, ext 207. Email: deidre@plexidors.net

F. Stainless-steel Cages
   1. STRAY CATS #112 -9 Single Movable Banks, 3 Cages High per set each Shor-Line Stainless-steel Cat Suite Part Number 902.3630.22 with Main space Cage size - 30" wide, 200 lbs. with tempered glass or solid stainless steel back.
      a. 42” w x 30” d x 24” tall x 3 cages high w/ 6” casters. Use tempered glass back on all cat suites/condos
   2. CAT QUAR. #110 -3 Single Movable Banks, 3 Cages High per set each. Shor-Line Stainless-steel Cat Suite Part Number 902.3630.22 with Main space Cage size - 30"wide, 200 lbs. with tempered glass or solid stainless steell back.
      a. 42” w x 30” d x 24” tall x 3 cages high w/ 6” casters. Use tempered glass back on all cat suites/condos
   3. CAT ISO. #111 -3 Single Movable Banks, 3 Cages High per set each. Shor-Line Stainless-steel Cat Suite Part Number 902.3630.22 with Main space Cage size - 30"wide, 200 lbs. with tempered glass or solid stainless steell back.
      a. 42” w x 30” d x 24” tall x 3 cages high w/ 6” casters. Use tempered glass back on all cat suites/condos
   4. CAT ADOPTION #108 -6 Single Movable Banks, 3 Cages High per set each. Shor-Line Stainless-steel Cat Suite Part Number 902.3630.22 with Main space Cage size - 30"wide, 200 lbs. with tempered glass or solid stainless steell back.
      a. 42” w x 30” d x 24” tall x 3 cages high w/ 6” casters. Use tempered glass back on all cat suites/condos
   5. SALLYPORT #139 -2 Single Movable Banks, 3 Cages High per set each. Shor-Line Stainless-steel Cat Suite Part Number 902.3630.22 with Main space Cage size - 36"wide, 200 lbs. with tempered glass or solid stainless steell back.
      a. 48” w x 30” d x 24” tall x 3 cages high w/ 6” casters. Use tempered glass back on all cat suites/condos
   6. All Cages Shall have the following features: Patented Hinge Design: US Patent #7,805,8808. Lockable Door Latch to prevent escapes, Silent Latch Mechanism to eliminate noises and creates stress-free environment for patients. Interior Polymer or stainless steel Resting Shelf and other Components are made of chemical resistant Polyethylene.
   7. All cage banks shall have 6” casters with a recessed platform so that the caster does not protrude beyond the plane of the cages, and shall be capable of being rolled outside
   8. Provide (one set per cat cage) Kennel Gear double stainless-steel bowls with door mount. Kennel Gear bowls equal to Shor-Line #190.0005.00. Bowls shall be 20oz x 2 mounts per cage color to be selected Verify, if pails are wanted in lieu bowls
   9. All cage assemblies shall have exterior side (closure) panels (sides and tops) to seal tight.

G. Outdoor Animal Enclosure and Outdoor runs provide MidMark outdoor runs with 9ga, 1 1/2 fabric, with no gaps or openings larger than 1 1/2" along sides, bottoms, and entire perimeter. All exterior framework made from Gatorshield ASTM A500 structural grade steel tubing, 1.050" pipe size OD, 0.94 pounds per foot weight, 50,000 psi (344738.00 kPa) min yield strength. Provide minimum of at least one intermediate vertical post equally spaced at a maximum 5’ OC

and at least one (1) intermediate rail at 30", and as recommended by manufacturer, for additional bracing. Height as indicated on drawings). Provide self-supported tops at all outdoor runs (support as recommended by manufacturer to prevent deflection).

1. Provide solid side panels full height at Dog Quarantine and Dog Isolation (54" at Stray Dog Runs and Adoption Runs, and full height at Quarantine and Isolation) all sealed to floor with Silvis Seal. Note that over Adoption kennels the side panels pass over a floor sloped to a drain of which the bottom channel will need to be slightly bent to follow the slope with no gap larger than 1" in the low point of the slope (at the drain – . Also note that front panels may be open fabric for the Iso, and Quarantine runs based on Owner's request since there is a secondary fence around Quarantine.
2. Close off all gaps along corners and edges to prevent nose to nose contact at Stray, Isolation and Quarantine. Mason Contact: Jim Hollowed jimhollowed@masonco.com

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb and level.

B. Completely protect epoxy floor coating from all damage during installation.

C. Provide stainless-steel tap-cons with minimum of 2-1/2" penetrations.

D. Install stainless-steel side panels set in complete, full and continuous bed of sealant, or silvis seal assembly to prevent cross contamination, beneath and shall be secured to floor, wall, and gate panel assembly. (Note: Bottom assembly set in sealant shall only be set in the presence of the architect or Owner unless otherwise agreed)

E. For all equipment items indicated herein and requiring utility connections, provide all necessary utilities including water supply and drain as required for a complete and operational system whether
   1. or not specifically shown on plumbing plans.

F. Kennel / Cage Installer: K&P Cage Builders (Shannon Kerns), Phone: (402) 419-0097, E-mail: sdkerns1@aol.com, or manufacturer and architect approved regional installer with documented similar experience and verifiable references.

END OF SECTION 11 4 0 10

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of animal enclosures are indicated on drawings.

1.03 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages that must be built into other work for installation of animal enclosures and related work; coordinate delivery with other work to avoid delay.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and erection of animal enclosure assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work. Provide full scale sample door assembly for approval to be returned or incorporated into project upon approval.

C. Mock-up: If required by Owner or Architect during the submittal process, provide full size mock up for review on the job site prior to fabrication for each type Kennel with resting bench, mobile cage, guillotine door, pass thru door (both installed in a masonry wall), and a cat enrichment box

1. WARRANTY
    a. Provide non prorated, no deductible, full-coverage warranty against material and labor for all animal equipment items including latch assemblies and all items listed in this specification section, for a length of three years from date of substantial completion.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Products specified are by:

1. MIdMark/ShorLine, Schroer Manufacturing Company 511 Osage, Kansas City, KS, 66105. 1-800-444-1570, Fax 1-913-281-5339 and are listed as a standard of quality. Contact Mark Shea - mshea@midmark.com
2. TriStar Vet / Direct Animal, 554 S. Allen Street, Boyd, TX 76023, . 1-877-459-7827, ext 23, Fax 1-940-433-5469and are listed as a standard of quality. Contact Tim Nichols - tim@tristar.com.

B. Products of MidMark, TriStar Vet, Suburban Surgical and LGL Animal Care, Inc. conforming to the specifications are acceptable. Note that all indoor kennel assemblies shall be provided by one manufacture. All outdoor kennel assemblies shall be provided by one manufacture. All cage bank assemblies shall be provided by one manufacture.

C. Substitutions: Under provisions of Section 01 60 00.

2.02 EQUIPMENT

A. Bathing (Grooming) tub and shower: Shor-Line Stainless Elite Grooming Tub: #904.0702.32or approved equal 56.125" (L) x 60.375" (H) x 24.59" (D) right hand door and left hand drain and spray head fixture #804.0006.52 or as appropriate for a functional unit as indicated on plan. Tub to include: Fold away step/ramp, 2 PVC Coated Tub Floor Panels-3 position floor, Access

Door, Hair Trap Drain Insert and Three-Sided Backsplash. Furnish all necessary utilities, services, material, and labor for the complete operation including final connections, whether specifically indicated in Documents.

B. Bi-Level sink / tub Table: Shor-Line 990.0400.00 or approved equal with stainless-steel legs, provide fully functional unit including all utility services and connections, and include deck mounted faucet: Shor-Line 804.0006.50 or as appropriate for complete unit with 8' heavy duty vinyl hose and aluminum spray head.

C. Mobile Animal Lift Table: Shor-Line #903.3120.00 with stainless-steel tabletop. Dim: 44.5" x 20" Includes: 4 locking casters and lifts up to 200 lbs.

D. Wet Table: Shor-Line #904.5000.00 60"x6" deep Stainless-steel Tub Insert into Stainless-steel Base with 2- doors and 3-drawers, Include Grill, Faucet, and Sprayer, Shor-Line # 804.0006.51

E. Surgical/Exam Lights: (Medical Rm 141) Qty: 1 Shor-Line Prelude Surgical LED ceiling mount light SKU #913.8000.04– Include all necessary power, support and blocking for a complete operational unit, refer to structural/manufactures information for mounting requirements

F. Scales: (Medical Rm 141, Intake Rm 130,) Shor-Line Walk on Scale SKU #905.5010.43 42" x 22" Floor Scale with Stainless-steel Top. 300 lb capacity

G. Pet station: DogiPot Pet Stations as manufactured by Dogipot 2100 Principal Row, Suite 405, Orlando, FL 32837 (800) 364-7681, http://www.dogipot.com Include fully functional stations as indicated in the drawings, provide one at each courtyard and coordinate final location with Architect prior to installation. Include the following:
   1. Junior Bag Dispenser (metal or our new poly dispenser)
   2. Metal or poly waste receptacle.
   3. Reflective DOGIPOT Sign 18" x 12" aluminum
   4. Two rolls @ 200 bags of opaque-green, 13" by 8", OXO-BIODEGRADABLE Litter Pick Up Bags
   5. One box @ 50 heavy-duty Trash Liner Bags
   6. Assembly Material
   7. Multipurpose 4' - 8' Telescope Post

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb and level.

B. Provide stainless-steel tap-cons with minimum of 2-1/2" penetrations.

C. Install stainless-steel side panels set in complete, full and continuous bed of sealant, or silvis seal assembly to prevent cross contamination, beneath and shall be secured to floor, wall, and gate panel assembly. (Note: Bottom assembly set in sealant shall only be set in the presence of the architect or Owner unless otherwise agreed)

D. For all equipment items indicated herein and requiring utility connections, provide all necessary utilities including water supply and drain as required for a complete and operational system whether or not specifically shown on plumbing plans

E. Kennel / Cage Installer: K&P Cage Builders (Shannon Kerns), Phone: (402) 419-0097, E-mail: sdkerns1@aol.com, or manufacturer and architect approved regional installer with documented similar experience and verifiable references.

END OF SECTION 11 4 0 20

PART 2 PRODUCTS

END OF SECTION 12 24 00

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for manufactured casework.

B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 12 31 00 - Manufactured Metal Casework.

B. Section 12 32 00 - Manufactured Wood Casework.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 21 00 - Allowances.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.

F. SEFA 2 - Installations Standard; 2020

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: See Section 12 31 00.

B. Solid Surface Countertops:

1. Configuration: Provide countertops with the following front and backsplash style:
    a. Front: Straight, slightly eased at top 3/4.
    b. Backsplash: straight, slightly eased at corner. Varies, reference interior elevations.

2. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   a. Manufacturers:
      1) Avonite Surfaces; _____: www.avonitesurfaces.com/#sle.
      2) Wilsonart; _____: www.wilsonart.com/#sle.
      3) Corian Solid Surface. www.corian.com
   b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   d. Color/Pattern Family: As indicated on inteior finish legend.
4. Other Components Thickness: 1/2 inch (12 mm), minimum.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

C. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
1. Flat Sheet Thickness: 1-1/4 inch (32 mm), minimum.
2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
   a. Manufacturers:
      1) Cambria Company LLC; ____: www.cambriausa.com/#sle.
      2) Cosentino North America; Dekton: www.cosentino.com/#sle.
   b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
   c. Finish on Exposed Surfaces: Polished.
3. Other Components Thickness: 3/4 inch (19 mm), minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

2.02 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: As specified on drawings.

PART 3 EXECUTION

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.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

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.

3.03 INSTALLATION

A. Install laboratory worksurface countertops in compliance with requirements of SEFA 2.

B. Install vanities in accordance with manufacturer’s instructions and approved shop drawings

C. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

D. Apply sealer products in accordance with manufacturer's written instructions.

E. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 36 00

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PART 1 GENERAL

1.01 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.

B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

1.02 GENERAL

A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the fire protection work in accordance with the Specifications, applicable drawings, and the conditions specified above.

B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

1.03 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and become familiar with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.

B. All proposals shall take these existing conditions into consideration, and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

C. The trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it, in the event that equipment specified and/or reviewed is incompatible with this requirement.

1.04 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Refer to other sections of the specifications for construction phasing and time increments.

B. The Contractor shall obtain and pay for all required utility connections, impact fees, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

1.05 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.

B. Latest edition of the National Fire Protection Association Standards (NFPA):

1. NFPA No. 13 Installation of Sprinkler Systems
2. NFPA No. 14 Installation of Standpipes and Hose Systems
3. NFPA No. 24 Installation of Private Fire Service mains and their Appurtenances
4. NFPA No. 70 National Electrical Code
5. NFPA No. 90A Installation of Air Conditioning and Ventilating systems
6. NFPA No. 91 Exhaust systems of Air Conveying of Gases, etc.
7. NFPA No. 96 Ventilation control and Fire Protection of Commercial Cooking Operations
8. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
9. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials

C. United States of America Standards Institute (ASA) Standards:

1. A40.8 National Plumbing Code
2. B31.1 & B31.1a Code for Pressure Piping

D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.

E. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these Specifications.

F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) 1985: All applicable manuals and standards.

G. American Society of Testing and Material (ASTM): All applicable manuals and standards.

H. American Water Works Association (AWWA): All applicable manuals and standards.

I. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.

J. City Fire Department as applicable to construction of this site.
K. City and State Building Codes.
L. State of Texas Occupational Safety Act: Applicable safety standards.
M. Refer to Specifications sections hereinafter bound for additional codes and standards.
N. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
O. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.06 CONTRACT DOCUMENTS

A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.
C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.
D. It is the Contractor's responsibility to properly use all information found on the Civil, Architectural, Structural, Mechanical and Electrical drawings where such information affects their work.
E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.
F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.
G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

1.07 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of fire protection, plumbing, mechanical, and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment they propose to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.
B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.
C. Maintain all Code required clearances for equipment access.

1.08 FABRICATION DRAWINGS

A. Each contractor shall submit shop drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit and other equipment, and (3) where called for elsewhere in the specifications.

B. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/8 inch equal to 1 foot.

1.09 SUPERVISION

A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.

B. It shall be the responsibility of each superintendent to study all drawings and become familiar with the work to be done by other trades. The Contractor shall coordinate this work with other trades, and before material is fabricated or installed, make sure that the work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for their ruling.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment. Include copies of all equipment warranties.

B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 8 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.11 GUARANTEE

A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.

B. Guarantee shall be for all labor and materials.

C. Certain items for equipment shall have additional or extended warranties when so specified.

1.12 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.

B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.13 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.14 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.15 SLEEVES, INSERTS AND FASTENINGS

A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.

B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.
D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.
E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.
F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.
G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.
H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.
I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

1.16 ACCESS DOORS

A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff, service or drain valves, and other items of concealed fire protection equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.
B. Refer to Architectural Division 08 Access Doors and Panels for requirements.

1.17 CONSTRUCTION REQUIREMENTS

A. The Civil, Architectural, Structural, Mechanical, Plumbing, and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying fire protection drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the fire protection drawings.
B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.
C. The Contractor shall be responsible for fitting their material and apparatus into the building and shall carefully lay out their work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.

D. The fire protection and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

E. When the drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.

F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

1.18 FIRE PROTECTION SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SUBMITTALS" for submittal definitions, requirements, and procedures.

B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect will not be processed.

C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.

D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.

E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

1.19 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 01 Section "SUBSTITUTION PROCEDURES" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect/Engineer's decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

Materials	Physical Size
Workmanship	Weight

Gauges of Materials	Appearance
Available Local Service Personnel	Performance
Previous successful installations	Capacity
Delivery Schedules	Required Equipment Clearances

C. Requests for substitutions for equipment, materials and apparatus listed in Division 21 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.
D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.
E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner or Architect/Engineer.

1.20 RECORD DOCUMENTS

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for requirements. The following paragraphs supplement the requirements of Division 01.
B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.21 PAINTING

A. Field painting of fire protection equipment, piping systems, etc., shall be accomplished under Division 09 of these specifications.
B. Protection of Factory-applied Finishes:
    1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.
    2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
    3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

1.22 CLEANING

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for general requirements for final cleaning.
B. Name Plates:
    1. All nameplates shall be protected from damage during the construction process.
    2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.
C. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by their work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

PART 2 PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, they shall bear all costs arising in connection with the deficiencies.

B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.

D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.

F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.

G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

H. The Contractor shall be responsible for the coordination and proper relation of their work to the building structure and to the work of all trades. The Contractor shall visit the premises and become familiar with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

2.02 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workres or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

2.03 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue the work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

2.04 PRECEDENCE OF MATERIALS

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of their own material and apparatus into the building.

B. Each Contractor shall so harmonize their work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed: See special conditions noted hereinafter for work integrated with structural systems.

1. Building lines
2. Structural members
3. Drain piping
4. Vent piping
5. Condensate piping
6. Refrigerant piping
7. Electrical bus duct
8. Supply ductwork
9. Return ductwork
10. Exhaust ductwork
11. Automatic Fire Protection Sprinkler Piping
12. Domestic hot and cold water piping
13. Electrical conduit

2.05 LOCATION OF OUTLETS IN ROOMS

A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect's reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.

B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

C. The Contractor, by submitting a bid on this work, sets forth that they have the necessary technical training and ability, and that they will install their work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, the Contractor shall report it to the Architect for correction promptly after discovery of the discrepancy.

PART 3 INSTALLATION

3.01 INSTALLATION METHODS

A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the building, unless otherwise indicated.

B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.

C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.

E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.

G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

3.02 CUTTING AND PATCHING

A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.

C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.

E. All fire protection work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

3.03 FABRICATION OF PIPE

A. All the various piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Lines shall also be graded for proper drainage.
B. Piping shall follow as closely as possible the routes shown on plans, but shall take into consideration conditions to be met at the site.
C. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval has been obtained.
D. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which lines are connected.
E. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage shall be removed. Pipe shall not be permitted to lie on the ground during storage. Pipe ends shall be sealed during storage.

3.04 IDENTIFICATION AND LABELING

A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.
B. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

3.05 TESTS AND INSPECTIONS

A. The Contractor shall, during the progress of the work and upon its completion, test their work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of their work.
B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at their own expense any damage caused by failures or leaks during the tests.
C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.
D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.
E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

3.06 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of their tools, equipment and materials and shall clean their debris from the job. Upon the completion of the job, each trade shall immediately remove all of their tools, equipment, any surplus materials and all debris caused by their portion of the work.

3.07 CLEANING AND PAINTING

A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

3.08 ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

A. The extent of electrical provisions to be provided as fire protection work is indicated in other sections of the specifications, on the drawings and as further specified in this section.

B. Starters, Controllers: In general, fire protection work includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as fire protection work.

C. Wherever possible, match the elements of the electrical provisions of fire protection work with similar elements of the electrical work specified in electrical sections of the specifications.

D. Standards:

1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

3.09 TEMPORARY FACILITIES

A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

3.10 EQUIPMENT INSTALLATION REQUIREMENTS

A. All fire protection equipment shall be furnished and installed complete and ready for use.

END OF SECTION 21 00 10

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.
B. Refer to Section 21 00 10 - General Requirements for Fire Protection Work
C. Refer to Section 22 00 10 - Basic Plumbing Requirements.
D. Refer to Section 23 00 10 - Basic Mechanical Requirements.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire protection (sprinkler) system	21	21	28
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch provide shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.
	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
2. Precedence for pipe, conduit and duct systems shall be as follows.
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Condensate piping
   f. Refrigerant piping
   g. Electrical bus duct
   h. Supply ductwork
   i. Return ductwork
   j. Exhaust ductwork
   k. Automatic Fire Protection Sprinkler Piping
   l. Domestic hot and cold water piping
   m. Electrical conduit
3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION 21 05 12

PART 1 GENERAL

1.01 SUMMARY

A. Extent of Fire Protection Piping Work required by this section is indicated on Drawings and by requirements of this section.

B. This section includes pipe, fittings and valves for Fire Protection Systems. Types of Fire Protection Piping Systems specified in this section include the following:
   1. Automatic Sprinkler Systems.

1.02 REFERENCES

A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
E. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded.
G. ANSI/ASME B16.25 - Buttwelding Ends.
H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
I. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
J. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
K. ANSI/ASTM A47 - Malleable Iron Castings.
L. ANSI/ASTM B32 - Solder Metal.
M. ANSI/AWS A5.8 - Brazing Filler Metal.
N. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
O. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
P. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
Q. ASTM A120 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.
R. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
S. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
T. NFPA 13 - Installation of Sprinkler Systems, latest edition

1.03 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.
B. Welding Materials and Procedures: Conform to ASTM Code and AWS D1O.12.
C. Employ certified welders in accordance with ANSI/ASME Section 9.
D. Valves: Bear UL or FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.04 REGULATORY REQUIREMENTS

A. Install in accordance with NFPA 13, City Fire Codes and Ordinances, and the requirements of Owner's Insurance Underwriter.
B. Piping materials specified herein are acceptable products to the Architect but all are not necessarily acceptable to applicable local codes and ordinances. It is the responsibility of the Contractor to provide materials, from the options listed herein that are acceptable to both the Architect and applicable local codes and ordinances.
C. Pipe sizes as shown on the Drawings are minimum pipe sizes. Contractor shall increase those pipe sizes if calculations so require, but under no circumstance shall pipe sizes be decreased.

1.05 SUBMITTALS

A. Prior to submittal to Architect, submit shop drawings, product data, and hydraulic calculations to the local Fire Marshal.
B. After approval from local Fire Marshal submit shop drawings, product data, and hydraulic calculations to Architect (with Certificate of Approval from local Fire Marshal and Owner's Insurance Underwriter for approval in accordance with Division 01 and Section 21 00 10.
C. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.
D. Indicate valve data and ratings.

E. Submit certificates as listed below to Architect in accordance with Division 01 and Section 21 00 10.
   1. Test Certificate of Approval for Piping System.

PART 2 PRODUCTS

2.01 PIPE, FITTINGS, AND VALVES

A. Provide above floor pipe, fittings, valves in accordance with City codes and ordinances, NFPA 13 for sprinkler and Owner's Insurance.
B. The minimum thin wall piping allowed shall be schedule 30 black steel for pipe up to 2 in. and Schedule 10 for pipe over 2 in. All thin wall piping shall be joined using rolled grooves with coupling.
C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; “C” shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.
   1. Acceptable Manufacturers:
      a. Victaulic
      b. Tyco (Grinnell Mechanical Products)
      c. Gruvlok (Anvil International)
D. For all threaded pipe, use Schedule 40.
E. Use FlexHead flexible sprinkler piping for run-outs to individual heads to center heads in lay-in ceilings.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends to full inside diameter.
B. Remove burrs and bevel plain end ferrous pipe.
C. Remove scale and foreign material, inside and outside, before assembly.

3.02 INSTALLATION - PIPE

A. Thread steel pipe joints up to and including 1-1/2 in. diameter. Thread, weld, or groove 2-in. diameter and larger, including branch connections.
B. Mechanical joints may be used instead of threaded or welded joints.
C. Die-cut threaded joints with full-cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
D. Coat threaded ends with pipe lubricant compound.
E. In steel piping, main sized saddle branch connections or direct connection of branch lines to mains is permitted if main is two pipe sizes larger than the branch. Do not project branch pipes inside the main pipe.
F. Install piping in accordance with NFPA 13, for sprinkler systems and NFPA 24 for private fire service mains and their appurtenances.
G. Do not penetrate or cut building structural members.
H. Provide sleeves when penetrating floors and walls.
I. Seal pipe and sleeve penetration to achieve fire and smoke resistance equivalent to fire and smoke separation.
J. Fire protection water service piping below building shall be provided with both flanged joints and thrust block restraint in accordance with NFPA 24. Flange bolts and nuts shall be stainless steel. Thrust block restraint shall be provided on the below floor elbow at the base of the riser. Area of bearing face of concrete thrust block shall be a minimum of 3.2 square feet.
K. Establish elevation of buried pipe outside the building to ensure not less than 3 ft. of cover over top of pipe.
L. Piping shall not run through grade beams. Piping shall run under grade beams.

3.03 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Provide drain valves at main shut-off valve and after all zone valves. In addition, provide auxiliary drains at all low points.
C. Adjust all pressure reducing valves to minimum pressures within the operating pressure range as required by NFPA 13. Fire Department valve outlet shall not exceed 150 psig. Automatic sprinkler systems shall not exceed 100 psig.

3.04 CLEANING

A. Flush entire piping system of foreign matter in accordance with NFPA 13.

3.05 TESTING

A. Hydrostatically test entire system in accordance with local Fire Marshal and NFPA 13 or 1-1/2 times the operating pressure, whichever is greater.
B. Test results shall be witnessed and approved by local Fire Marshal.
C. Submit Test Certificate of Approval for Piping System stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor and local Fire Marshal.

END OF SECTION 21 11 00

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of Automatic Sprinkler Fire Extinguishing System Work required by this section is indicated on Drawings and by requirements of this section.

B. This section includes design and provisions of an Automatic Sprinkler Fire Extinguishing System. Types of Fire Extinguishing Automatic Sprinkler Systems specified in this section include the following:
   1. Wet Pipe System
   2. Dry Pipe System (if required at outdoor kennels)

1.02 REFERENCES

A. NFPA 13 - Installation of Sprinkler Systems, latest edition.

B. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances, latest edition.

1.03 DESIGN CRITERIA

A. System to provide coverage for entire building.

B. Interface system with building fire and smoke alarm system.

C. Design systems to the occupancy requirements of NFPA 13, City Codes and Ordinances, and the Owner's Insurance Underwriter.

D. Provide Fire Department connection.

E. Provide detailed shop drawings of the automatic sprinkler systems in accordance with NFPA 13.

F. Provide hydraulic calculations of the automatic sprinkler systems in accordance with NFPA 13. Hydraulic calculations shall not exceed 90% of the available pressure.

1.04 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.

B. Equipment and Components: Bear UL label or marking.

C. Specialist Firm: Company specializing in sprinkler systems design and installation, Licensed Fire Protection Contractor by the Texas State Board of Insurance Underwriters with minimum three years' experience.

1.05 REGULATORY REQUIREMENTS

A. Design and install in accordance with NFPA 13, City Codes and Ordinances and the requirements of Owner's Insurance Underwriter.

B. Pipe sizes as shown on the Drawings are minimum pipe sizes. Contractor shall increase those pipe sizes if calculations so require at no additional cost, but under no circumstance shall pipe sizes be decreased.

1.06 SUBMITTALS

A. Prior to submittal to Architect submit shop drawings, product data, and hydraulic calculations to local Fire Marshal and Owner's Insurance Underwriter.

B. After approval from local Fire Marshal and Owner's Insurance Underwriter submit shop drawings, product data and hydraulic calculations to Architect (with Certificate of Approval from local Fire Marshal and Owner's Insurance Underwriter) for approval in accordance with Division 01 and Section 21 00 10.

C. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.

D. Submit certificates as listed below to Architect in accordance with Division 01 and Section 21 00 10.
   1. Test Certificate of Approval for equipment and system operation.

1.07 PROJECT RECORD DOCUMENTS

A. Submit documents in accordance with Division 01 and Section 21 00 10 .

1.08 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's operation and maintenance data under provisions of Division 01 and Section 21 00 10.

B. Include written maintenance data on components of system, servicing requirements, and Record Drawings.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place under provisions of Division 01 and Section 21 00 10.

1.10 EXTRA STOCK

A. Provide extra sprinkler heads under provisions of NFPA 13.
B. Provide suitable wrenches for each head type.
C. Provide metal storage sprinkler head and wrench cabinet in location designated.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. See Section 21 00 10.

2.02 ALARM CHECK VALVE

A. Alarm Check Valve: Automatic flow detector with alarm circuits, pressure switch, retard chamber, and electric alarm bell .

2.03 DRY-PIPE VALVE

A. Dry-pipe Valve: Valves shall be equipped to give a local low-air pressure signal at 65% of the normal air pressure carried in the system. Valves shall be provided with standard trimming, including priming connection, water and air pressure gauges, pressure switches, priming water level test facilities, alarm testing bypass, accelerator, and all necessary pipe, fittings and accessories required to provide a complete installation.

2.04 AIR SUPPLY SYSTEM

A. Air supply systems for dry pipe system shall be provided from new air compressor.
B. Air Compressor: Single stage air-cooled type, designed to maintain the required pressure on the system. Motor shall be capable of operating the compressor at rated capacity continuously without exceeding the nameplate rating and shall be provide with thermal overload protection. Motor control shall be provided with an adjustable pressure switch to automatically start and stop the motor as required.
C. Drum Drips: Drum drips shall be installed in accordance with NFPA 13. The installation shall be so made that the sprinkler system is not impaired while condensate is being removed from the piping.

2.05 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connection: Cast brass body, polished chrome plated brass finish, two-way sidewalk type, 2-1/2 in. x 2-1/2 in. x 4 in. with polished chrome plated brass swivels. Fire Department connection shall be provided with polished chrome plated brass plugs, chains, 18 in. sleeve, and round plate lettered "Standpipe" and/or "Auto-Spkr". Threading on inlets of fire Department connections shall be same as Municipal Fire Department threads. Provide Potter Roemer model approved equal.

2.06 SPRINKLER HEADS

A. Suspended Ceiling Type:
   1. Fully recessed pendent type with white cover plate.
   2. For dry-pipe system installations, provide "dry" pendent type as specified above.
   3. In all electrical and mechanical rooms provide high temperature rated at 286°F pendant type sprinkler heads with sprinkler head guards.
   4. The use of o-ring sealed sprinkler heads is prohibited.
B. Hard Ceiling Type: Fully recessed pendent type with white cover plate.
C. Exposed Area Type: Standard upright types with chrome finish.
D. Fusible Link: Temperature rated for specific area hazard.
E. Guards: Finish to match sprinkler head.

2.07 ELECTRIC SWITCHES

A. Alarm switch:
   1. Vane type, 24 VDC, adjustable retard (wet system only).
   2. Pressure Type, Snap Action, NEMA 4 construction, 5 psi to 15-psi adjustment range, 24 VDC (dry system only). Designed to activate alarm on increase in pressure.
B. Supervisory switch:
   1. OS&Y gate valve type, 24 VDC.

2. Pressure switch: 24 VDC.

2.08 ALARM BELL

A. Exterior Alarm Bell: Electric 10 in. diameter, weatherproof, 97 dB at 10 ft. 0 in., 24 VDC, marked "Sprinkler Alarm."

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate Work of this Section with other affected work.

3.02 INSTALLATION

A. Installation shall be in accordance with NFPA 13.
B. Locate fire department connection in accordance with City requirements with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of Fire Department wrench handles.
C. Locate exterior alarm bell on outside building wall next to riser.
D. Place pipe runs to minimize obstruction to other work.
E. Place piping in concealed spaces above finished ceilings.
F. Center heads two directions in 2 ft. 0 in. x 2 ft. 0 in. ceiling tile and provide piping offsets as required.
G. Apply strippable tape or paper cover to ensure sprinkler heads do not receive field paint finish.
H. Provide excavation, bedding, backfilling and compaction in accordance with Division 31 for work in this section.
I. Installation of preaction system and accessories shall be in accordance with manufacturer's recommendations.
J. Provide 3/4-in. ball drip at low point of fire department connection and pipe to floor drain or through exterior wall.
K. Provide 24 in. x 24 in. x 6 in. thick reinforced concrete collar around base of sidewalk fire department connection.
L. All sprinkler heads in gymnasiums, other activity areas, or any other areas where sprinkler head may be susceptible to damage by building occupants shall be protected with wire guards.
M. Sprinkler heads located under glass or plastic skylights exposed to direct rays of sun shall be intermediate temperature classification.
N. All interconnecting power, control, and alarm wiring between preaction battery charger/power supply and all system components shall be by Fire Protection Contractor. Electrical Contractor shall provide power supply to battery charger/power supply unit and provide connected supervisory and alarm circuits.
O. Dry sprinkler systems located in areas with ceilings shall be concealed with dry pendant type sprinkler heads.

3.03 SYSTEM TESTS

A. Test dry pipe system, wet pipe system, alarm switches, supervisory switches, electric alarm bells, and interfacing with building fire and smoke alarm system to ensure proper operation. Tests shall be performed in accordance with the City Fire Marshal, Factory Mutual, and NFPA 13.
B. Tests shall be witnessed and approved by local Fire Marshal.
C. After completion and approval of testing submit "Test Certificate of Approval" for alarm switches, supervisory switches, and electric alarm bells stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor.

3.04 DEMONSTRATION OF SYSTEM AND EQUIPMENT

A. Prior to final acceptance, Contractor and Manufacturer’s Representative shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the preaction sprinkler system including associated accessories and controls.
B. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the wet pipe automatic sprinkler system and dry pipe automatic sprinkler system including associated accessories and controls.

C. After completion and approval of demonstrations, submit "Demonstration Certificates of Completion" for wet pipe automatic sprinkler system and dry pipe automatic sprinkler system including all associated accessories and controls stating that the Demonstrations of the systems are satisfactory. Certificates must be signed by the Manufacturer's Representative, Contractor, Owner, Architect, and Engineer.

END OF SECTION 21 13 00

PART 1 GENERAL

1.01 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.

B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

1.02 GENERAL

A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the plumbing work in accordance with the Specifications, applicable drawings, and the conditions specified above.

B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

1.03 COMMISSIONING

A. The Contractor shall provide all System Commissioning services as required by Section C408 of the 2021 IECC. Mechanical systems shall comply with Section C403 and Electrical Power and Lighting systems shall comply with Section C405.

B. Commissioning, as outlined in Section C408 shall include the following:
   1. A Commissioning Plan
   2. Air Systems Balancing
   3. Hydronic Systems Balancing
   4. Functional Performance Testing for all Mechanical equipment, controls and economizers.
   5. Functional Performance Testing for all Lighting controls
   6. A Preliminary Commissioning Report
   7. Final Documentation including Drawings, O&M Manual, T&B Report, Final Commissioning Report.

1.04 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.

B. All proposals shall take these existing conditions into consideration, and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

C. The trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it, in the event that equipment specified and/or reviewed is incompatible with this requirement.

1.05 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Refer to other sections of the specifications for construction phasing and time increments.

B. The Contractor shall obtain and pay for all required utility connections, impact fees, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

1.06 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.

B. Latest edition of the National Fire Protection Association Standards (NFPA):
   1. NFPA No. 70 National Electrical Code
   2. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
   3. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials

C. United States of America Standards Institute (ASA) Standards:
   1. A40.8 National Plumbing Code
   2. B31.1 & B31.1a Code for Pressure Piping

D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.

E. American Society of Testing and Material (ASTM): All applicable manuals and standards.

F. American Water Works Association (AWWA): All applicable manuals and standards.
G. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.
H. City and State Building Codes.
I. State of Texas Occupational Safety Act: Applicable safety standards.
J. Occupational Safety and Health Act (OSHA).
K. State of Texas Energy Conservation Construction Code.
L. All work shall be in accordance with all regulations and requirements of the State of Texas Architectural Barriers Act (TAS).
M. Refer to Specifications sections hereinafter bound for additional codes and standards.
N. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
O. All equipment provided and all installation methods shall meet all applicable requirements of the International Energy Conservation Code.
P. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.07 CONTRACT DOCUMENTS

A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.
C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.
D. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Fire Protection, Plumbing, Mechanical and Electrical drawings where such information affects his work.
E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.
F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.
G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

1.08 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of plumbing, mechanical and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.
B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

1.09 FABRICATION DRAWINGS

A. Each Contractor shall submit shop drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit and other equipment, and (3) where called for elsewhere in these specifications.

B. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/4 in. equal to 1 ft. by the Contractor.

1.10 SUPERVISION

A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.

B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate this work with other trades, and before material is fabricated or installed, make sure that his work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for his ruling.

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment.

B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 4 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.12 GUARANTEE

A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.

B. Guarantee shall be for all labor and materials.

C. Certain items for equipment shall have additional or extended guarantees when so specified.

1.13 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.

B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.14 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.15 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.16 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide chrome plated brass floor and ceiling plates around all pipes, conduits, ducts, etc., passing exposed through walls, floors, or ceilings, in any spaces, except under floor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4 in. above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have plates made to fit accurately at all floor, wall and ceiling penetrations.

1.17 SLEEVES, INSERTS AND FASTENINGS

A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.

B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.

D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.

E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.

F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.

G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.

I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

1.18 ACCESS DOORS

A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff or service valves, fire and/or smoke dampers, and other items of concealed mechanical equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.

B. Access doors mounted in painted surfaces shall be equal to Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be minimum of 18 in. x 18 in. in size.

1.19 CONSTRUCTION REQUIREMENTS

A. The Architectural, Structural, Fire Protection, Mechanical and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying fire protection drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the mechanical drawings.

B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.

C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.

D. The plumbing and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

E. When the plumbing drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.

F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

1.20 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 01 Section "SUBSTITUTION PROCEDURES" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect/Engineer's decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

	Materials	Physical size
	Workmanship	Weight
	Gauges of Materials	Appearance
	Available Local Service Personnel	Performance
	Previous successful installations	Capacity
	Delivery Schedules	Required Equipment Clearances

C. Requests for substitutions for equipment, materials and apparatus listed in Division 22 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.

D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.

E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner, Architect, or Engineer.

PART 2 PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.

D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.

F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.

G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

H. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

2.02 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workmen or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

2.03 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue his work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

2.04 PRECEDENCE OF MATERIALS

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of his material and apparatus into the building.

B. Each Contractor shall so harmonize his work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed: See special conditions noted hereinafter for work integrated with structural systems.

1. Building lines
2. Structural members
3. Drain piping
4. Vent piping
5. Condensate piping
6. Refrigerant piping
7. Electrical bus duct
8. Supply ductwork
9. Return ductwork
10. Exhaust ductwork
11. Automatic Fire Protection Sprinkler Piping
12. Domestic hot and cold water piping
13. Electrical conduit

2.05 LOCATION OF OUTLETS IN ROOMS

A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect's reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.

B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

C. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install his work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, he shall report it to the Architect for correction promptly after discovery of the discrepancy.

2.06 CONNECTIONS FOR OTHERS

A. This Contractor shall rough-in for and make all gas, water, steam, sewer, etc., connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, along with actual measurements of the equipment connections, or as detailed.

B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.

C. Provide all air gap fittings where required. In each water line serving an item of equipment or piece of machinery, provide a shut-off valve. On each drain not provided with a trap, provide a suitable trap.

D. All pipe fittings, valves, traps, etc., exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome plated to match.

2.07 WALL HUNG CARRIERS

A. Provide floor mounted carriers for all wall mounted fixtures.

PART 3 INSTALLATION

3.01 INSTALLATION METHODS

A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the building, unless otherwise indicated.

B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.

C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.

E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.
F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.
G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

3.02 CUTTING AND PATCHING

A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.
B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.
C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.
E. All plimbing work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken.

3.03 ROOF PENETRATIONS

A. Pipe and duct sleeves and flashings compatible with the roofing installation shall be provided for roof penetrations. Manufacturer of roofing materials shall approve methods and materials.
B. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.
C. Pitch pans are not acceptable.

3.04 FABRICATION OF PIPE

A. All the various piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Lines shall also be graded for proper drainage.
B. Piping shall follow as closely as possible the routes shown on plans, but shall take into consideration conditions to be met at the site.
C. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval has been obtained.
D. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which lines are connected.
E. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage shall be removed. Pipe shall not be permitted to lie on the ground during storage. Pipe ends shall be sealed during storage.

3.05 IDENTIFICATION AND LABELING

A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.

B. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates constructed from laminated phenolic plastic, at least 1/16 in. thick, 3-ply, with black surfaces and white core. Engraving shall be condensed gothic, at least 1/2 in. high, appropriately spaced. Nomenclature on the label shall include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Equipment to be labeled shall include, but not be limited to, the following:
   1. Domestic Water Heaters
   2. Motor controllers
   3. Miscellaneous similar and/or related items.

C. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

D. Refer to 22 05 53 for Plumbing Piping Identification.

3.06 TESTS AND INSPECTIONS

A. The Contractor shall, during the progress of the work and upon its completion, test his work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of his work.

B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at his own expense any damage caused by failures or leaks during the tests.

C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.

D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.

E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

3.07 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by his portion of the work.

3.08 CLEANING AND PAINTING

A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.

C. All canvas finishes shall be painted with one sizing coat if not already sized, containing a mildew resistant additive and Arabol adhesive prior to any other specified finish paint.

D. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

3.09 ELECTRICAL PROVISIONS OF PLUMBING WORK

A. The extent of electrical provisions to be provided as plumbing work is indicated in other sections of the specifications, on the drawings and as further specified in this section.

B. Starters, Controllers: In general, plumbing includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as plumbing work.

C. Electrical heating equipment shall be furnished complete with internal or integral fusing and subdivision of loads to comply with the NEC.

D. Wherever possible, match the elements of the electrical provisions of plumbing work with similar elements of the electrical work specified in electrical sections of the specifications.

E. Standards:

1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

3.10 TEMPORARY FACILITIES

A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

3.11 EQUIPMENT INSTALLATION REQUIREMENTS

A. All equipment shall be furnished and installed complete and ready for use.

B. Others shall furnish certain kitchen equipment. Contractor shall be responsible for furnishing and installing all items as required to make kitchen equipment complete operating systems. The Contractor shall furnish and install all auxiliary piping, valves, controls, control wiring, conduit, alarms, etc., required. All necessary devices, control wiring, conduit, etc., will not necessarily be shown on the drawings.

3.12 EXCAVATION, BACKFILLING AND COMPACTION

A. Provide excavation, backfilling and compaction in accordance with requirements of Division 31.

3.13 OWNER FURNISHED EQUIPMENT

A. The Contractor’s responsibility shall include receiving and installing all Owner furnished equipment.

END OF SECTION 22 00 10

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.
B. Refer to Section 21 00 10 - General Requirements for Fire Protection Work
C. Refer to Section 22 00 10 - Basic Plumbing Requirements.
D. Refer to Section 23 00 10 - Basic Mechanical Requirements.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire protection (sprinkler) system	21	21	28

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch provide shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.
	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.
	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
   1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
   2. Precedence for pipe, conduit and duct systems shall be as follows.
      a. Building lines
      b. Structural members
      c. Soil and drain piping
      d. Vent piping
      e. Condensate piping
      f. Refrigerant piping
      g. Electrical bus duct
      h. Supply ductwork
      i. Return ductwork
      j. Exhaust ductwork
      k. Automatic Fire Protection Sprinkler Piping
      l. Domestic hot and cold water piping
      m. Electrical conduit
   3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
   1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION 22 05 12

PART 1 GENERAL

1.01 SUMMARY

A. Extent of meters and gauges required by this section is indicated on Drawings and/or specified in other Division 22 sections.

B. Types of meters and gauges specified in this section include the following:
   1. Temperature Gauges and Fittings.
      a. Glass Thermometers.
      b. Thermometer Wells.
      c. Temperature Gauge Connector Plugs.

C. Gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
   2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

C. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data and product data in Maintenance Manual; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 GLASS THERMOMETERS

A. General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9 in. long.

C. Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.

D. Tube and Capillary: Glycerin filled, magnifying lens, 1 percent scale range accuracy, shock mounted.

E. Scale: Satin faced, non-reflective aluminum, permanently etched markings.

F. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.

G. Range: Conform to the following:
   1. Hot Water: 30° - 240°F with 2°F scale divisions (0° - 160°C) with 2°C scale divisions).

H. Manufacturer: Subject to compliance with requirements, provide glass thermometers of one of the following, or approved equal.
   1. Ernst Gage Co.
   2. Marshalltown Instruments, Inc.
   3. Trerice (H.O.) Co.
   4. Weiss Instruments, Inc.
   5. Weksler

2.02 THERMOMETER WELLS

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2-in. extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

B. Manufacturer: Same as thermometers.

2.03 TEMPERATURE GAUGE CONNECTOR PLUGS

A. General: Provide temperature gauge connector plugs pressure rated for 500 psi and 200°F (93°C). Construct of brass and finish in nickel-plate, equip with 1/4 in. NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 in. O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

B. Manufacturer: Subject to compliance with requirements, provide temperature gauge connector plugs of one of the following, or approved equal:

1. Peterson Equipment Co.
2. Watts Regulator Co.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At outlet of each hot water mixing valve.
2. At inlet and outlet of each tank type water heater.

C. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

D. Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.03 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 19

PART 1 GENERAL

1.01 SUMMARY

A. Extent of supports and anchors required by this section is indicated on Drawings and/or specified in other Division 22 sections.
B. Types of supports and anchors specified in this section include the following:
   1. Pipe and equipment hangers, supports, and anchors.
   2. Equipment bases.
C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
B. Codes and Standards:
   1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
   2. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
      b. Select and apply pipe hangers and supports, complying with MSS SP-69.
      c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
      d. Terminology used in this section is defined in MSS SP-90.

1.03 SUBMITTALS

A. Submit product data and maintenance data as required under provisions of Division 01 and Section 22 00 10.
B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
B. Adjustable Steel Clevis Hangers: MSS Type 1.
C. Steel Pipe Clamps: MSS Type 4.
D. Pipe Hangers: MSS Type 5.
E. Adjustable Swivel Pipe Rings: MSS Type 6.
F. Split Pipe Rings: MSS Type 11.
G. Extension Split Pipe Clamps: MSS Type 12.
H. U-Bolts: MSS Type 24.
I. Clips: MSS Type 26.
J. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
K. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.

2.02 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

2.03 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. Steel Turnbuckles: MSS Type 13.

C. Swivel Turnbuckles: MSS Type 15.

D. Malleable Iron Sockets: MSS Type 16.

2.04 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

B. Top Beam C-Clamps: MSS Type 19.

C. Side Beam or Channel Clamps: MSS Type 20.

D. Center Beam Clamps: MSS Type 21.

E. Welded Beam Attachments: MSS Type 22.

F. C-Clamps: MSS Type 23.

G. Top Beam Clamps: MSS Type 25.

H. Side Beam Clamps: MSS Type 27.

I. Steel Beam Clamps W/Eye Nut: MSS Type 28.

J. Malleable Beam Clamps: MSS Type 30.

K. Steel Brackets: One of the following for indicated loading:

1. Light Duty: MSS Type 31, suspending 750 lbs. max.
2. Medium Duty: MSS Type 32, suspending 1500 lbs. max.
3. Heavy Duty: MSS Type 33, suspending 3000 lbs. max.

L. Side Beam Brackets: MSS Type 34.

M. Plate Lugs: MSS Type 57.

2.05 CONCRETE INSERTS

A. Cast-In-Place Spot Type: Malleable iron, or steel with recommended insert nut. Size inserts nut to suit threaded hanger rod. MSS SP-69, Type 18.

B. Drill-In Spot Type: Steel, attached wedge, lock washer and nut. Size inserts to suit threaded hanger rod.

1. Acceptable Manufacturers and Models:
   a. Hilti "Kwik Bolt"
   b. Ramset "Wedge Anchor"
   c. Rawl "Stud"

C. Continuous Channel Type: Steel, anchoring lugs, with channel nuts, rated for 2000 lbs. per foot minimum load. Size channel nut to suit threaded hanger rod.

1. Acceptable Manufacturers and Models:
   a. B-Line B22
   b. Elcen 1150
   c. Unistrut P3200

2.06 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.07 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
   1. B-Line Systems Inc.
   2. ITT Grinnell Corp.

2.08 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Auxiliary Steel: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.09 ROOF PENETRATION SYSTEMS

A. General: Construct roof penetration systems utilizing the “Alumi-Flash” system by Portals Plus, Inc., or equal by Thy-Curb.

B. Each roof penetration shall include a spun aluminum base (“High” size if required due to the existing roof construction and any insulation thickness) and an EPDM rubber cap. Each rubber cap shall have a pre-molded pipe opening and shall be selected based on the actual pipe or conduit size required at each location. Secure each rubber cap to each pipe or conduit with the manufacturer’s recommended stainless steel gear clamp.

C. Manufacturer: Subject to compliance with requirements, provide roof penetration systems of one of the following:
   1. Portals Plus, Inc.
   2. Thycurb Div.; Thybar Corp.

2.10 CONCRETE HOUSEKEEPING BASES

A. Concrete housekeeping bases shall be in accordance with Division 03 and constructed of 3,000 psi concrete and reinforced with welded wire fabric in accordance with ASTM A 185 or deformed reinforcing bar in accordance with ASTM A 615, Grade 60.

B. Reinforcement shall be provided for base thickness as follows unless otherwise noted:

	Thickness of Base	Size and Type of Reinforcement	Spacing and Location of Reinforcement
	4 in.	W 2.9 x 2.9 welded	6 in. x 6 in. at centerline of pad
	6 in.	No. 3 bars	18 in. on center each way (3 in. from top of pad)
	8 in.	No. 4 bars	18 in. on center each way (3 in from top of pad)
	12 in.	2 sets of No. 4 bars	Two mats 18 in. on center each way (3 in. from top of pad and 3 in. from bottom of pad)

2.11 SLEEVES, INSETS AND FASTENINGS

A. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports that are copper plated, or by other recognized industry methods.

E. Support and laterally brace vertical pipe runs at every floor level and at intervals not to exceed 20 ft. 0 in. Support vertical pipe with riser clamps installed below hubs, couplings or lugs welded to the pipe.

F. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Insulated Piping: Comply with the following installation requirements.
   1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.
   3. Do NOT utilize "pipe size" hangers with insulation placed over the pipe and hanger.

3.05 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
D. Anchor spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 CONCRETE HOUSEKEEPING BASES

A. Provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Division 22 in accordance with Division 03. Size bases to extend minimum of 4 in. beyond equipment base in any direction; and 4 in. above finished floor elevation, unless otherwise noted on Drawing. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.07 EQUIPMENT SUPPORTS

A. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.08 ADJUSTING AND CLEANING

A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments.
B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 29

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of mechanical identification work required by this section is indicated on Drawings and/or specified in other Division 22 sections.

B. Types of identification devices specified in this section include the following:
   1. Plastic Pipe Markers.
   2. Plastic Tape.
   3. Plastic Equipment Markers.

C. Plumbing identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division 22 sections.

D. Refer to Division 21, 23 and 26 sections for identification requirements of fire protection, mechanical and electrical work; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
   1. Allen Systems, Inc.
   2. Brady (WHO) Co.; Signmark Div.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.

2.02 IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, and pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.

C. Small Pipes: For external diameters less than 6 in. (including insulation if any), provide full-band pipe markers, extending 360° around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.
   3. Laminated or bonded application of pipe marker to pipe (or insulation).
   4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 in. wide; full circle at both ends of pipe marker, tape lapped 1-1/2 in.

D. Large Pipes: For external diameters of 6 in. and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   1. Laminated or bonded application of pipe marker to pipe (or insulation).
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 in. wide; full circle at both ends of pipe marker, tape lapped 3 in.
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Manufacturer's standard pre-printed nomenclature that best describes piping system in each instance, in cases of variance with name as shown or specified.

2.04 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2 in. wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6 in., 2-1/2 in. wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:
   1. Green: Cooling equipment and components.
   2. Yellow: Heating equipment and components.
   3. Yellow/Green: Combination cooling and heating equipment and components.
   4. Blue: Equipment and components that do not meet any of the above criteria.
   5. Red: Fire protection equipment and components.
   6. For hazardous equipment, use colors and designs recommended by ANSI A13.1.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
   1. Name and plan number.
   2. Equipment service.
   3. Design capacity.

C. Size: Provide approximate 2-1/2 in. x 4 in. markers for control devices, dampers, and valves; and 4-1/2 in. x 6 in. for equipment.

2.06 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
   1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification that indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
   1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible 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 intermediately at maximum spacing of 50 ft. along each piping run, except reduce spacing to 25 ft. in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

C. Piping Identification:

	System	Background Color	Text Color
	Domestic Cold Water	Green	White
	Domestic Hot Water	Yellow	Black
	Domestic Hot Water - Recirculated	Yellow	Black
	Natural Gas	Yellow	Black
	Condensate Drain Piping	Green	White

3.03 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   2. Meters, gauges, thermometers and similar units.
   3. Fuel-burning units including water heaters.
   4. Pumps and similar motor-driven units.
   5. Tanks and pressure vessels.
   6. Strainers, filters and similar equipment.

B. Optional Sign Types: Where lettering larger than 1 in., height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 1/4 in. for distances up to 6 ft. 0 in., and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
   1. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at Installer's option, be identified by installation of plasticize tags in lieu of engraved plastic signs.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device, which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 22 05 53

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PART 1 GENERAL

1.01 SUMMARY

A. Adjust and balance plumbing hot water recirculation systems
B. Check each piece of operating equipment provided under Division 22.
C. Provide Balancing Report

1.02 REFERENCES

A. Reference Standards: Comply with AABC National Standards for Total System Balance, latest edition.

1.03 SUBMITTALS

A. Balancing Report: At completion of work, submit balancing report in accordance with Section 22 00 10. After adjustments have been made submit three (3) copies of a complete detailed report on mechanical systems and their operation to include:
   1. Blackline prints with balance valves marked to correspond with data sheets and with thermometer locations clearly marked.
   2. Data sheets showing amount of water at balance valves, instrument used.
   3. Operating data including pump RPM, measured motor current and voltage BHP and flow (GPM).
   4. Equipment and operating data including water temperatures entering and leaving the thermostatic mixing valve.
   5. A statement outlining any abnormal or notable conditions not covered in above data. Make special note of any discrepancies between tabulated data and specified conditions.

1.04 PROJECT CONDITIONS

A. Existing Conditions: Verify following conditions before proceeding with work:
   1. Installation of the designated system is complete and in full operation.

PART 2 PRODUCTS

2.01 INSTRUMENTS

A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of AABC.
B. Calibration histories for each instrument shall be available for examination.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect preceding work in accordance with Section 22 00 10 "BASIC PLUMBING REQUIREMENTS".

3.02 PREPARATION

A. Water Systems: Check:
   1. Strainers are clean.
   2. Automatic control valves operation.
   3. Pump rotation.
   4. Other conditions as required.

3.03 ADJUSTING AND BALANCING

A. General: Check, adjust and balance hot water recirculation system to meet the design performance and tabulate results on acceptable forms. Minimum data to include amperage, voltage input, and thermal heater capacity of each pump, equipment nameplate data and operating speed, pressure rise across each pump, GPM capacity of each balance valve.
B. Test Run: In order to determine that the system installation is complete and will operate satisfactorily, make a test run with equipment operating per normal temperature control schedule and sequence. Run test and operate and adjust equipment as may be required during test run.

3.04 COMPLETION SERVICES

A. Final Check: Make final checks and do any rebalancing as directed.

B. Report: Submit Balancing Report as specified above.
C. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. Owner reserves the right to spot check the report by field verification prior to final acceptance.

END OF SECTION 22 05 93

PART 1 GENERAL

1.01 SUMMARY

A. Extent of mechanical insulation required by this section is indicated on Drawings and schedules, and by requirements of this section.
B. Types of mechanical insulation specified in this section include the following:
   1. Piping System Insulation:
      a. Fiberglass.
      b. Flexible Unicellular.
C. Refer to Section 22 05 29 "PLUMBING SUPPORTS AND ANCHORS" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
D. Refer to Section 22 05 53 "PLUMBING IDENTIFICATION" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
C. Flame/Smoke Ratings: Provide composite mechanical (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
   1. Exception: Outdoor mechanical insulation may have flame-spread index of 75 and smoke developed index of 150.
   2. Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame-spread index of 75 and smoke developed index of 150.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Armstrong World Industries, Inc.
   2. Knauf Fiber Glass.
   3. Johns Manville Products Corp.
   4. Owens-Corning Fiberglass Corp.
   5. Pittsburgh Corning Corp.

2.02 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated.
B. Flexible Unicellular Piping Insulation: ASTM C 534, Type I.
C. Jackets for Piping Insulation: ASTM C 921, Type I (Vapor Barrier) for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installer’s option.
   1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.

D. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealers and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Thickness of insulation shall be as recommended by the manufacturer for the temperatures and pipe sizes involved, and in accordance with standards of T.I.M.A.

3.02 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

B. Cold Water Piping:
   1. Application Requirements: Insulate the following cold plumbing piping systems:
      a. Potable cold water piping.
      b. Plumbing vents within 6 linear ft. of roof outlet.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass: 1/2 in. thick for pipe sizes up to and including 1-1/2 in., 1 in. thick for pipe sizes over 1-1/2 in.

C. Cold Drain Piping:
   1. Application Requirements: Insulate the following cold drain piping systems:
      a. Condensate drains from HVAC units, refrigerated equipment, etc., including traps and lateral lines concealed above ceilings.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Flexible Unicellular: 1/2 in. thick for pipe sizes up to and including 1-1/2 in., 1 in. thick for pipe sizes over 1-1/2 in.

D. Hot Water Piping:
   1. Application Requirements: Insulate the following hot plumbing piping systems:
      a. Potable hot water piping.
      b. Potable hot water recirculating piping.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass (Above Ground Only): 1 in. thick for pipe sizes up to and including 1-1/2 in., 1-1/2 in. thick for pipe sizes over 1-1/2 in.

E. Insulation compliance:
   1. All piping insulation conductivity values, minimum thickness and temperature ratings shall comply with 2015 IECC, Table C403.2.10.

3.03 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 in. wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 in. wide vapor barrier tape or band.
I. Do NOT insulate over pipe hangers. If pipe hangers for piping to be insulated are not adequately sized for insulation to pass through the hanger, notify the General Contractor and Architect.

3.04 INSULATION EXPOSED TO WEATHER

A. Protect outdoor insulation from weather by installation of weather-barrier metal jacketing. Metal jacketing shall be Aluminum. It may be factory-applied or field applied. Joints shall be overtapped a minimum of 2 inches. Securement shall be accomplished by using screws, rivets, or stainless steel bands. Any vapor-barrier jacket or coating under the metal jacketing shall not be disturbed or punctured by the use of screws or rivets on the outer jacket.

3.05 EXISTING INSULATION REPAIR

A. Repair damaged sections of existing piping insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

3.06 PROTECTION AND REPLACEMENT

A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture-saturated units.
B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 07 16

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of Plumbing Piping Work required by this section is indicated on Drawings and by requirements of this section.
B. Types of Plumbing Piping systems specified in this section include the following:
   1. Sanitary waste and vent system.
   2. Domestic water system.
   3. Miscellaneous Drain Lines
   4. Trap primer-piping system.

1.02 REFERENCES

A. ANSI/ASME B16.18 - Cast Copper Alloy Solder - Joint Pressure Fittings.
B. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
F. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.
G. ANSI/ASTM B32 - Solder Metal.
H. ANSI/ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
I. ANSI/AWS D1.1 - Structural Welding Code.
J. AWS D10.12 - Recommended Practices and Procedures for Welding Plain Carbon Steel Pipe.
K. AWS D10.9 - Qualifications and Procedures for Piping and Tubing Welding.
L. AWS B3.0 - Welding Procedure and Performance Qualification.
M. ASME - Boiler and Pressure Vessel Code.
N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
O. ASTM A74 - Cast Iron Soil Pipe and Fittings.
P. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
Q. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
R. ASTM B88 - Seamless Copper Water Tube.
S. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
T. ASTM C 1540 - Heavy Duty Shielded Hubless Couplings
U. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
V. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.
W. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
X. ASTM D2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-flow Applications.
Y. ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain Waste and Vent Pipe and Fittings.
Z. ASTM D2680 - Acrylonitrile - Butadiene - Styrene (ABS) Composite-Sewer Piping.
AA. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
BB. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
CC. ASTM F477 - Electrometric Seals (Gaskets) for Joining Plastic Pipe.
DD. AWS A5.8 - Brazing Filler Metal.
EE. AWWA C601 - Standard Methods for the Examination of Water and Waste Water.
FF. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
GG. CISPI 310 - Couplings for Use with Hubless Cast Iron Soil Pipe and Fittings.
HH. ASTM D2564 - Solvent Cements for Poly (vinyl) (chloride) (PVC) Plastic Pipe and Fittings.

1.03 QUALITY ASSURANCE

A. Plumbing Certification: Persons performing plumbing work shall have a current Texas State Plumbing License.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Welding Materials and Procedures: Conform to ASME Code and AWS 10.12.

D. Welders Certification: In accordance with ANSI/ASME Sec. 9 or AWS D1.1, AWS D10.9, and AWS B3.0, as applicable.
E. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer.

1.04 REGULATORY REQUIREMENTS

A. Conform to the most recent editions of the applicable City codes and ordinances.
B. Piping materials specified herein are acceptable products to the Architect/Engineer, but all are not necessarily acceptable to applicable local codes and ordinances. It is the responsibility of the Contractor to provide materials, from the options listed herein, that are acceptable to both the Architect/Engineer and applicable local codes and ordinances.

1.05 SUBMITTALS

A. Submit product data on pipe materials, fittings, valves and accessories in accordance with Division 01 and Section 22 00 10.
B. Submit shop drawings and piping layout in accordance with Division 01 and Section 22 00 10.
C. Submit certificates as listed below to Architect in accordance with Division 01 and Section 22 00 10.
   1. Test Certificates of Approval for Piping Systems.
   2. Flushing Certificates of Approval for Piping Systems.
   3. Disinfection Certificates of Approval for Domestic Water Piping Systems.

PART 2 PRODUCTS

2.01 SANITARY WASTE AND VENT PIPING

A. Sanitary waste and vent piping, buried beyond 5 ft. of building.
   1. See Section 33.
B. Sanitary waste and vent piping, below grade.
   1. PVC Pipe: ASTM D2665, Schedule 40. Fittings: PVC DWV Type, Schedule 40, and ASTM D2665. Joints: ASTM D2855 and D2564, solvent weld. Reference ASTM D23221 for installation.
C. Sanitary waste and vent piping, above grade.
   1. Cast Iron Pipe & Fittings: CISPI 301, hubless. Joints: ASTM C 564, neoprene gaskets and stainless steel clamp-and-shield assemblies. Joints shall be Heavy Duty couplings conforming to ASTM C 1540 as manufactured by Husky SD 4000, Clamp All 125, or Ideal Tridon Heavy Duty.

2.02 WATER PIPING

A. Water piping buried beyond 5 ft. of building.
   1. See Section 33.
B. Water piping buried within 5 ft. of building, and beneath slab.
   1. Copper Tubing: For 2-1/2 in. diameter and less, ASTM B88, Type "L" . Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: AWS A5.8, BCuP silver braze.
   2. Cross-linked Polyethylene (PEX) Pipe: For 1 in. and smaller, ASTM F876 and ASTM A877, SDR9 tubing. PEX piping may be used for below ground trap primer piping only.
C. Water piping, above grade.
   1. Copper Tubing: For 4 in. diameter and less, ASTM B88, Type "L", hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

2.03 MISCELLANEOUS DRAIN PIPING

A. Condensate Drain Piping:
   1. Copper pipe; ASTM B306, DWV fittings; ANSI/ASME B16.3, cast bronze, or AWSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 50B.

2.04 TRAP PRIMER PIPING

A. Trap primer piping, buried and above grade.
   1. Copper Tubing: ASTM B88, Type L, annealed. Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

2. PEX piping as specified above may be used only when concealed within walls and below floor.

2.05 FLANGES, UNIONS AND COUPLINGS

A. Pipe Size 2 in. and under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2 in.: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; gaskets suitable for intended service – NO ASBESTOS GASKET MATERIAL ALLOWED.

C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.
   1. Acceptable Manufacturers:
      a. Victaulic
      b. Tyler/Gustin-Bacon

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.06 GATE VALVES

A. Gate valves: For water shut - off.
   1. Gate valves 2 in. and less: MSS-SP-70, rated 175 lb. minimum water pressure, brass or bronze construction screw-in bonnet, rising stem, solid wedge disc, threaded or soldered connections.
   2. Acceptable Manufacturers and Models:
      a. Crane 438, 1334
      b. Nibco T-111, S-111
      c. Grinnell ITT 3010, 3010SJ
      d. Milwaukee 148, 149

2.07 BALL VALVES

A. Ball valves: For water shut-off and throttling.
   1. Ball valves 2 in. and less: Rated 175 lb. minimum water, oil, air and gas pressure, brass or bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections. Throttling valves shall be provided with memory stops (for establishing any setpoint from 0-100% flow).
      a. Acceptable Manufacturers and Models:
         1) Crane 9302, 9322
         2) Jomar T-100-SS
         3) ITT Grinnell 3500, 3500SJ
         4) Milwaukee BA-200, BA-250
         5) Watts B-6000, B-6001
         6) Nibco T-580, & S-500

2.08 CHECK VALVES

A. Swing check valves: For water, air, and pumped waste and drain.
   1. Check Valves 2 in. and less: MSS SP-80 rated 175 lb. minimum water and air pressure, brass or bronze construction, renewable seat, bronze disc, threaded or soldered connections.
      a. Acceptable Manufacturers and Models:
         1) Nibco T-413
         2) Crane 137
         3) Jomar T/S-511
         4) Stockham B-321
         5) Milwaukee 508

2.09 PRESSURE REDUCING VALVES

A. Pressure reducing valves: For water.
   1. Pressure Reducing Valve: Rated 175 lb minimum water pressure, brass or bronze construction, adjustable pressure range threaded connections for 2 in. and less or flanged connections for 2-1/2 in. or larger.

a. Acceptable Manufacturers:
   1) Armstrong
   2) Watts

2.10 EXCAVATION, BACKFILLING AND COMPACTING

A. Provide excavation, backfilling and compacting in accordance with Division 31 .

2.11 PIPING SPECIALTIES

A. Provide piping specialties in accordance with Section 22 11 19.

2.12 PLUMBING SUPPORTS AND ANCHORS

A. Provide supports and anchors in accordance with Section 22 05 29.

2.13 PLUMBING METERS AND GAUGES

A. Provide meters and gauges in accordance with Section 22 05 19.

2.14 PLUMBING INSULATION

A. Provide mechanical insulation in accordance with Section 22 07 16.

2.15 PLUMBING IDENTIFICATION

A. Provide mechanical identification of all piping system and valves in accordance with Section 22 05 53.

PART 3 EXECUTION

3.01 PIPING

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
E. Route piping in orderly manner and maintain gradient.
F. Install piping to conserve building space and not interfere with use of space.
G. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
H. Group piping whenever practical at common elevations.
I. Exposed piping, valves, fittings, escutcheons, trim, etc., serving plumbing fixtures in finished areas, shall be polished chromium plated. Exposed piping, valves, fittings, escutcheons, trim, etc., serving plumbing equipment, kitchen equipment, or other equipment located in finished areas, shall be chrome plated, or when not available with chrome plating, they shall be painted with chromium paint.
J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
K. Provide clearance for installation of insulation and access to valves and fittings.
L. Provide access where valves and equipment are not accessible. Coordinate size and location of access doors with applicable Section.
M. Slope water piping and arrange to drain at low points.
N. Establish elevations of buried piping outside the building to ensure not less than 3 ft. of cover.
O. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
P. Install piping parallel with or at right angles to walls unless otherwise shown on Drawings.
Q. Conceal piping above ceilings, in walls or chases etc., unless otherwise shown or noted on Drawings.
R. Joints in soft copper piping below slab will not be allowed.
S. Joints in PEX tubing below slab shall not be allowed.
T. Soft copper shall not be routed through areas with exposed ceilings.
U. Bending of rigid piping is not permitted; only ells shall be utilized for a change in direction.
V. Temporarily plug or cap open ends of pipe at the end of each workday.
W. Establish invert elevations for drainage piping. Minimum slopes for drainage are 1/4 in. per foot for 3 in. diameter and less and 1/8 in. per ft. for 4 in. diameter pipe and greater.
X. Install bell and spigot pipe with bell end upstream.

Y. Trap primer piping shall slope to floor drain at no less than 1/16 in. per ft. Horizontal trap primer piping shall run below floor. Piping in slab is not permitted.
Z. Install vented U-type drain trap on all draw-thru cooling coil drain pans.
AA. Materials exposed within ducts or plenums (ceiling spaces used as supply or return air plenums) shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials, U.B.C. Standard No. 42-1. Do not install any PVC piping in any Return Air Plenums.
BB. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.
CC. Support vertical piping at every floor.
DD. A pressure reducing valve station shall be furnished and installed on incoming domestic cold water lines with pressure exceeding 80 psi. Furnish valve station with separate strainer.
EE. Installation of PVC plastic drainage piping under floor and underground shall be in compliance with ASTM D2321 Latest Edition “Standard Practice for Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications”. Minimum trench width shall be pipe diameter plus 16 in. and all bedding material shall meet Class 1A or Class 1B bedding criteria.
FF. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.
GG. PEX tubing shall be cut with a PEX tubing cutter. Tubing shall be cut squarely and in a workmanlike manner to permit a proper connection between the tubing and fitting.

3.02 PIPING CONNECTIONS

A. Threaded Connections
   1. Threaded joints shall be in accordance with ANSI B1.20.1. Threaded joints shall be made up Teflon tape or lead free pipe joint compound applied to the male thread only. Should a joint be loosened after being made up, it shall not be made up a second time unless the threads are cleaned and new compound applied.
   2. All steel piping which is assembled with screwed joints shall have exposed threads thoroughly primed with a coat of lead free rust resistant paint. Paint immediately after installation. This shall apply to both piping that is to be covered as well as uncovered.

B. Soldered Connections
   1. Soldered joints shall be in accordance with ASTM B32. Flux shall be nonacid type. Remove composition discs from solder end valves during soldering. Pipe ends, fittings and valves shall be properly cleaned before soldering and wiped clean to remove flux and excess solder after soldering.

C. Welded Connections
   1. Welded joints shall be in accordance with AWS D10.12-79. The oxyacetylene or electric process shall make all joints.
   2. Nipples or half couplings welded into the mains will not be accepted. Welded branch connections shall be used to tap mains only where the mains are at least two pipe sizes larger than the branch.
   3. All openings cut into pipe for welded outlets shall be accurately made, to give matched intersections. For welded branch outlet fittings, the opening shall be cut before the fittings welded.
   4. Long radius type ells shall be on all bends in welded pipelines. No field fabricated or factory segmentally fabricated fittings shall be allowed.
   5. Welds on piping shall be cleaned and primed with corrosion resistant paint before insulation is applied or installation is complete.

D. Mechanically Formed Connections:
   1. Manufacturer of forming equipment as “Acceptable Application” lists size and wall thickness of both run tube and branch tube.
   2. Height of drawn collar is not less than three times wall thickness of run tubing.
   3. End of branch tube is notched to conform to inner curve of run tube, and dimpled to set exact penetration depth into collar.

4. Resulting joint is minimum of three times as long as thickness of thinner joint member, and brazed using B-Cup series filler metal.

E. Mechanical Grooved Connections:
   1. Pipe shall be prepared and mechanical grooved connections shall be assembled in accordance with ANSI/AWWA C606 and the latest published instructions from the manufacturer.

F. PEX Tubing Connections:
   1. PEX Press Connections: Bronze PEX press fittings shall be made in accordance with the manufacturer's installation instructions.
      a. The stainless steel press sleeve shall be placed over the end of the squared off PEX tubing while fully inserting the fitting barb into the tubing.
      b. The press connection shall be made with PEX tubing and press fitting manufacturer's recommended press tool.
   2. PEX Crimp Connections: Brass PEX insert fitting shall be made in accordance with the manufacturer's installation instructions.
      a. The copper crimp ring shall be placed over the end of the squared off PEX tubing then the PEX crimp fitting shall be fully inserted into the tubing.
      b. The copper crimp ring shall be positioned according to the manufacturer's recommendations.
      c. The PEX crimp connection shall be made with the PEX tubing and crimp fitting manufacturer's recommended crimp tool.
   3. PEX Adapter Connections: Adapter connections shall be made in accordance with PEX installation requirements as well as the adjoining piping installation requirements referenced within these specifications.

3.03 FLANGES AND UNIONS

A. Provide flanges and unions at all final connections to equipment, and traps. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.
B. All flanged connections shall be in accordance with ANSI B16.5 for steel flanges and ANSI B16.1 for cast iron flanges.
C. Bolting shall be in accordance with ASTM A307 Grade B with bolts and nuts in accordance with ANSI B18.2.1 and ANSI B18.2.2.
D. Tighten flange bolts in sequence 180° directly opposite each to equal tension.
E. Flanges and unions shall be made of same material or compatible material as piping systems in which they are installed.

3.04 VALVES

A. Install valves with stems upright or horizontal, not below horizontal.
B. Horizontal swing check valves shall be installed in a true horizontal position. Vertical lift check valves shall be installed in a true vertical position.
C. Install ball valves for shut-off and to isolate equipment, parts of systems, or vertical risers.
D. Install ball valves for throttling, bypass or manual flow control services.
E. Throttling or balancing valves shall be provided with memory stops.

3.05 PRESSURE REDUCING OR REGULATING VALVES

A. Pressure reducing or regulating valves shall be provided with pressure gauges on inlet and outlet side of valve.
B. Adjust pressure reducing or regulating valves for proper outlet pressure and provide valve tag attached to valve body indicating required pressure setting.
C. Provide shut-off valve ahead of each pressure reducing or regulating valve.

3.06 TESTING

A. General: Furnish pumps, gauges, equipment and personnel required, and test as necessary to demonstrate the integrity of the finished installation.
B. Soil, Waste and Vent: Unless otherwise directed, plug all openings and fill with water to a height equal to the lowest vent. Allow to stand one hour or longer as required. Remake leaking joints and retest.
C. Water Lines: Hydrostatically test and make tight at 150 psi. Retain for four hours. Repair all leaking joints and retest.

D. Tests and test procedures shall be witnessed and approved by the Owner.
E. After completion and approval of testing, submit "Test Certificates of Approval" for Sanitary Waste and Vent, Water, and Drain piping systems stating that all test results are satisfactory. Certificates of approval must be signed by Contractor and Owner.

3.07 FLUSHING

A. General: After piping systems have been tested and approved, systems shall be flushed. Furnish compressors, pumps, equipment, personnel, etc. required to flush piping systems.
B. Water Lines: Flush piping with water until water flows clear for a minimum of 60 seconds per 100 linear ft. of piping being flushed at a velocity of 9 ft. per second.
C. All strainers and filters shall be cleaned and replaced prior to start-up.
D. Flushing and flushing procedures shall be witnessed and approved by the Owner.
E. After completion and approval of flushing, submit "Flushing Certificates of Approval" for water and natural gas piping systems stating that all flushing results are satisfactory. Certificates of approval must be signed by Contractor and Owner.

3.08 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.
B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50-to 80 mg/L residual.
C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 5 remote outlets.
D. Maintain disinfectant in system for 24 hours.
E. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
F. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
G. Take samples no sooner than 24 hours after flushing, from 5 remote outlets and from water entry, and analyze in accordance with AWWA C601.
H. Disinfection and disinfection procedures shall be witnessed and approved by the Owner.
I. After disinfection is completed, submit "Disinfection Certificate of Approval" for domestic water piping systems stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor and Owner. Certificate shall show the date, time and residual of each of the following tests:
    1. Initial disinfection residual (50 PPM minimum) - 5 samples.
    2. Final disinfection residual (25 PPM minimum) - 5 samples.
    3. After flushing residual (5 PPM maximum) - 5 samples.
    4. Analyze in accordance AWWA C601 - 5 samples.

3.09 CLOSING IN UNINSPECTED WORK

A. Do not cover up or enclose work until it has been properly and completely inspected and approved. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been completely inspected and approved, make all repairs and replacements as necessary to the satisfaction of the Architect, Engineer, and Owner's Representative. Repairs and replacements shall be at no additional cost to the Owner.

END OF SECTION 22 10 00

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PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of Plumbing Specialties Work required by this section is indicated on Drawings and by requirements of this section.

B. Types of Plumbing Specialties specified in this section include the following:

1. Floor drains.
2. Area drains.
3. Floor sinks.
4. Hub drains.
5. Trench drains.
6. Cleanouts.
7. Interceptors.
8. Backflow preventers.
9. Vacuum breakers.
10. Water hammer arrestors.
11. Trap primers.
12. Thermostatic mixing valves.
13. Hose bibs.
14. Wall hydrants.
15. Drain Flashings
16. Special Sanitary waste and vent fittings
17. Expansion tanks

1.02 REFERENCES

A. ANSI/ASSE 1015 - Backflow Preventers, Double Check Principle.
B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
D. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
E. ANSI A112.21.1 - Floor Drains and Area Drains.
F. ANSI A112.21.2 - Roof Drains.
G. ANSI A112.26.1 - Water Hammer Arresters.
H. PDI WH-201 Water Hammer Arresters.

1.03 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.
B. Manufacturer: For each product specified, provide components by same manufacturer throughout.
C. Plumbing Certification: Persons performing plumbing work shall have a current Texas State Plumbing License.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable City codes and ordinances .

1.05 SUBMITTALS

A. Submit product data in accordance with Division 01 and Section 23 00 10.
B. Include component sizes, rough-in requirements, service sizes, and finishes.
C. Submit Certificates as listed below to Architect in accordance with Division 01 and Section 23 00 10.

1. Certificates of Approval - Backflow Preventers.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

A. Floor drain: ANSI A112.21.1; cast iron body, double drainage flange, weep holes, bottom outlet, 6 in. dia. nickel bronze adjustable flat strainer, and non-puncturing flashing collar.

1. Acceptable Manufacturers and Models:
   a. Josam Series 30000-S
   b. Watts Series FD-100-M

c. Approved equal.

2.02 AREA DRAINS

A. Area drain: ANSI A112.21.1; cast iron body, double drainage flange, weep holes, bottom outlet, vandal proof secured 8 in. dia. cast iron adjustable extra heavy duty grate.
   1. Acceptable Manufacturers and Models:
      a. Josam Series 76010
      b. Watts Series FD-460
      c. Approved equal.

2.03 FLOOR SINK DRAINS

A. Floor sink drain: ANSI A112.21.1; square cast iron body, double drainage flange, weep holes, bottom outlet, aluminum dome strainer, non-puncturing flashing collar, porcelain enamel or epoxy coated interior, and half grate. Size 12 in. x 12 in. x 8 in.
   1. Acceptable Manufacturers and Models:
      a. Josam Series 49340A
      b. Watts Series FS-740
      c. Approved equal.

2.04 HUB DRAIN

A. Hub drain: Cast bronze body and supplementary dome strainer, 5 in. diameter top and P-trap.
   1. Acceptable Manufacturers and Models:
      a. Josam Series 88210-8-72
      b. Approved equal.

2.05 TRENCH DRAINS

A. Trench drains: Cast iron body, rectangular sections, anchor flange, inside caulk bottom outlet, dimension and grate as scheduled.
   1. Acceptable Manufacturers:
      a. Josam
      b. Watts

2.06 CLEANOUTS

A. Floor clean out: Cast iron body, adjustable type, no-hub or inside caulk connection, stainless steel round top, threaded ABS plug.
   1. Acceptable Manufacturers and Models:
      a. Josam Series 55000-SS
      b. Zurn Series CO-1200-R
      c. Approved equal.

B. Floor Clean out: Provide special carpet clean out cover with clean out marker in all carpeted areas and special recessed cover which will allow for the same flooring material to be installed in clean out top in all areas with tile or vinyl flooring material. Recessed cover shall be designed for type of flooring.

C. Wall clean out: Recessed wall type, cast iron body with threaded bronze plug, flush mounted stainless steel access cover with countersunk center screw .
   1. Acceptable Manufacturer and Models:
      a. Josam Series 58910-19
      b. Watts Series CO-460-RD
      c. Approved equal.

2.07 BACKFLOW PREVENTERS

A. Double Check
   1. Double check backflow preventer 2 in. and smaller: ANSI/ASSE 1015; complete unit of two independently acting check valves, two ball valves, strainer and four test cocks, bronze or iron body with bronze internal parts, 150 psi working pressure, and shall comply with AWWA Standard C-510. Lead free.
      a. Acceptable Manufacturers and Models:
         1) Watts LF007
         2) Approved equal.

B. Reduced Pressure

1. Reduced pressure backflow preventer 2 in. and smaller: ANSI/ASSE 1013; complete unit of two independently acting check valves together with an automatically operating pressure relief valve, two ball valves, strainer, and four test cocks, bronze or iron body with bronze internal parts, 150 psi working pressure, and shall comply with AWWA Standard C506. Lead free.
    a. Acceptable Manufacturers and Models:
        1) Watts LF909
        2) Approved equal.

C. Backflow Preventer Test Kits
1. Double Check Principle Test Kit: Gauge tubing models, adaptors, test hardware and lightweight case.
    a. Acceptable Manufacturer and Model:
        1) Watts TK-7
        2) Approved equal.
2. Reduced Pressure Principle Test Kit: Gauge test valves, hoses, adaptors, securing strap, instruction guide and lightweight case.
    a. Acceptable Manufacturer and Model:
        1) Watts TK-9A
        2) Approved equal.

2.08 VACUUM BREAKER

A. Atmospheric Vacuum Breakers
1. Atmospheric type vacuum breaker (AVB): ASSE 1001, ANSI 112.1.1; brass body and internal parts, silicone rubber disc, polished chrome plated finish, and threaded connections. Lead free.
    a. Acceptable Manufacturer and Model:
        1) Watts LF288A
        2) Approved equal.

B. Pressure Vacuum Breakers
1. Pressure type vacuum breaker (PVB): ASSE 1020; 150 psi rated, brass or stainless steel construction, silicone rubber disc, ball valve shut-offs, test cocks, and threaded connections. Chrome plated when exposed in finished areas. Lead free.
    a. Acceptable Manufacturer and Model:
        1) Watts LF800M4QT
        2) Approved equal.

2.09 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors (WHA): ANSI A112.26.1, ASSE 1010, and PDI WH-201; permanently sealed expanding chamber type . Sizing symbols indicated on Drawings refer to Plumbing and Drainage Institute “Standard PDI-WH201” established standard classifications. Air chambers are not allowed.
1. Acceptable Manufacturers and Models:
    a. Expanding Chamber Type
        1) Watts Series 15M2
        2) Approved equal.

2.10 TRAP PRIMERS

A. Trap Primer: Brass, O-ring seals, with the minimum quantity of distribution units as recommended by manufacturer. Trap primer shall automatically activate and deliver 5 ounces of water on a 15 second 1-psi pressure drop. Lead free.
1. Acceptable Manufacturer and Model:
    a. Watts LFTP300
    b. Approved equal.

B. Trap Primer Connection Adapter: Cast iron, with 1/2 in. NPT primer tap for use with multiple drains.
1. Acceptable Manufacturers and Models:
    a. Watts LFTP300-DR
    b. Approved equal.

2.11 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valve: Thermostatic type to automatically close hot water port if cold-water pressure fails or close cold-water port if hot water pressure fails, and closes both ports if thermostatic element fails. Valve shall be lead free, minimum 0.5 gpm, ASSE 1017 compliant.
   1. Acceptable Manufacturers and Models:
      a. Powers LFLM490
      b. Approved equal.

2.12 HOSE BIBS

A. Hose bib: Chrome plated bronze, provided with wall flange, 1/2 in. female inlet, 3/4" garden hose male outlet.
   1. Acceptable Manufacturers and Models:
      a. T & S Brass B-0702
      b. Approved equal.

2.13 WALL HYDRANTS

A. Non-freeze wall hydrant: ANSI/ASSE 1019; exposed wall hydrant type, with chrome plated brass or nickel bronze finish on brass castings, freezeless, 3/4 in. hose thread nozzle, integral vacuum breaker, and loose key handle.
   1. Acceptable Manufacturers and Models:
      a. Watts HY-420
      b. Approved equal.

2.14 EXPANSION TANKS

A. Expansion Tanks: Factory fabricated expansion tanks shall be furnished with each storage-type water heater. Water heaters with 200,000 BTU and larger input capacities or larger than 119 gallons storage shall be furnished with ASME coded expansion tanks.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate forming of floor construction to receive drains to required invert elevations.

3.02 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
B. Extend cleanouts to finished floor or wall surface. Lubricate threaded clean out plugs with mixture of graphite and linseed oil. Ensure clearance at clean out for rodding of drainage system.
C. Encase yard cleanouts in concrete flush with grade when not located in concrete, pavement, sidewalk, etc.
D. Trap all drains connected to the sanitary sewer.
E. Install floor and area drains with top depressed 1/2 in. below finished floor elevation.
F. In addition to cleanouts, as shown on the Drawings, Contractor shall provide any additional cleanouts required by local codes and ordinances at no additional cost to the Owner.
G. Outlet of plumbing vents and flues shall be located a minimum of 10 ft. 0 in. from fresh air intakes. Provide offset as required.
H. Relief valve discharge drain from reduced pressure backflow preventers shall be piped full outlet size down to nearest floor drain. Drain line shall terminate above floor drain with air gap.
I. Special sanitary waste and vent fittings shall be designed in accordance with local codes and installed in accordance with manufacturer's shop drawings and installation recommendations.
J. One backflow preventer test kit shall be provided for each type of backflow preventer (Reduced Pressure Principle or Double Check Principle) provided by the Contract Documents.
K. Pipe Flashing:
   1. Open-end dry vent pipes passing through roof waterproofing membrane shall be installed through a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 in. from the pipe and shall be set over the roof membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe and turn down into the pipe to form a waterproof joint. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed with tightly pack fiberglass wool insulation.

2. Closed end pipes passing through roof waterproofing membrane shall be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing-clamp device, pressure ring with brass bolts and deck clamping assembly. Flashing shield shall be fitted into the sleeve-clamping device.

L. Install trap primers on all floor drains unless specifically not required by local codes.

M. All trap primers shall be concealed, within cabinets, walls and/or chases as approved by the Architect. Install access doors at each valve location.

3.03 TESTING

A. Backflow preventers shall be tested for proper operation by the backflow preventer Manufacturer's Representative. The test shall be performed prior to initial start-up. Manufacturer's Representative shall submit certificates of approval to the Architect.

END OF SECTION 22 10 01

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of piping specialties work required by this section is indicated on Drawings and schedules and by requirements of this section.

B. Types of piping specialties specified in this section include the following:
   1. Pipe Escutcheons.
   2. Pipeline Strainers.
   3. Dielectric Unions.
   4. Mechanical Penetration Seals.
   5. Fire Barrier Penetration Seals.
   6. Drip Pans.
   7. Pipe Sleeves.
   8. Penetration Seals.

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned Drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop Drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.02 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter tightly fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: Exterior use and interior use including mechanical rooms and any room with water or floor type drains. For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

D. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following or approved equal:

1. Chicago Specialty Mfg. Co.
2. Producers Specialty & Mfg. Corp.
3. Sanitary-Dash Mfg. Co.

2.03 LOW PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64 in. perforations @ 233 per sq. in.

B. Threaded Ends, 2 in. and Smaller: Cast-iron body, screwed screen retainer with centered blow down fitted with pipe plug.

C. Manufacturer: Subject to compliance with requirements, provide low pressure Y-type strainers of one of the following or approved equal:
1. Armstrong Machine Works.
2. Hoffman Specialty ITT; Fluid Handling Div.
3. Metraflex Co.
4. R-P&C Valve; Div. White Consolidated Industries, Inc.
5. Spirax Sarco.
6. Trane Co.
7. Victaulic Co. of America.
8. Watts Regulator Co.

2.04 DIELECTRIC UNIONS

A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

B. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following or approved equal:
1. B & K Industries, Inc.
2. Capital Mfg. Co.; Div. of Harsco Corp.
3. Eclipse, Inc.
4. Epco Sales, Inc.
5. Perfection Corp.
6. Rockford-Eclipse Div.

2.05 PENETRATION SEALS

A. Caulked Seals: Provide seals for penetrations through interior walls of one of the following:
1. Mineral Wool or Oakum: Caulked watertight between sleeve and pipe.

B. Mechanical Seals:
1. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
2. Manufacturer: Subject to compliance with requirements, provide mechanical sleeve seals of one of the following or approved equal.
   a. Thunderline Corp.

C. Fire Barrier Seals:
1. Provide seals for any opening through smoke or fire-rated walls, and all above grade floors, used as passage for mechanical components such as piping or ductwork.
2. Cracks, Voids, or Holes Up to 4 in. Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.
3. Openings 4 in. or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F UL-listed.
4. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following or approved equal.
   a. Electro Products Div./3M.
   b. Nelson; Unit of General Signal.

2.06 DRIP PANS

A. General: Provide drip pans fabricated from 20 gauge corrosion-resistant sheet metal with watertight joints, and with edges turned up 2+ in. Reinforce top, either by structural angles or by rolling top over 1/8 in. steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1 in. drain line connection.

2.07 PIPE SLEEVES

A. Provide pipe sleeves of one of the following:
   1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3 in. and smaller, 20 gauge; 4 in. to 6 in. 16 gauge; over 6 in., 14 gauge.
   2. Steel-Pipe: Fabricate from Schedule 10 (minimum) steel pipe; remove burrs.
   3. Floor sleeves shall be provided with water stop around perimeter of sleeve.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2 in. and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
   1. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
      a. Pumps.
      b. Temperature control valves.
      c. Pressure reducing valves.
      d. Temperature or pressure regulating valves.

C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

D. Mechanical Penetration Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

E. Fire Barrier Penetration Seals: Fill opening with sealing compound. Adhere to manufacturer's installation instructions.

F. Drip Pans: Locate drip pans under piping passing over or within 3 ft. horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1 in. drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

G. Pipe Penetrations: Sleeve new construction or core drill existing construction pipe penetrations as specified below where piping passes through walls, floors, and roofs. Do not penetrate structural members, except as detailed on Drawings, or as reviewed by Architect. Install penetrations accurately centered on pipe runs. Size penetrations so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide penetration with sufficient clearance for installation. When sleeves are required, install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves two inches above finished floor. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeve. Pipe penetrations shall be as follows:

1. New floors on grade: Provide sleeved penetrations for all piping except piping two inches and less and waste, drain, and vent piping. Piping not requiring sleeves shall be provided with 30 lb. asphalt saturated roofing felt wrapped around pipe through the thickness of the floor with concrete floor placed up to roofing felt.
2. New floors above grade: Provide sleeved penetrations for all piping.
3. Existing Floors Above Grade: Provide core-drilled penetrations for all piping.
4. New and Existing Walls: Provide sleeved or core drilled penetrations for all piping.
5. Floor type drains, cleanouts, and water closet waste connections do not require sleeved or core drilled penetrations. Concrete shall be placed tight to connection.
6. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.

H. Pipe Sleeves: Install in accordance with the following:
1. Install sheet metal on steel pipe sleeves in interior walls.
2. Install steel pipe sleeves in interior floors above grade.
3. Install galvanized steel pipe sleeves in floors on grade and in exterior walls above grade and below grade.

I. Penetration Seals:
1. Install mineral wool/oakum seals as follows:
   a. In interior walls where piping passes from one space to another, where any one of the spaces the piping penetration is not concealed by a ceiling. Caulk penetration watertight.
2. Install mechanical seals in accordance with manufacturer's recommendations as follows:
   a. In interior floors on grade.
   b. In interior floors above grade, use three-hour fire rated type only.
   c. In exterior walls above grade and below grade.
   d. In all roof penetrations except vent piping, flue piping, roof or overflow drain piping or any other piping as otherwise detailed on Drawing.
3. Install fire barrier seals in accordance with manufacturer's recommendations as follows:
   a. In all floors above grade, roofs and fire rated walls.

END OF SECTION 22 11 19

PART 1 GENERAL

1.01 SUMMARY

A. Extent of Plumbing Equipment Work required by this section is indicated on Drawings and Schedules, and by requirements of this section.
B. Types of Plumbing Equipment specified in this section include the following:
   1. Domestic water heaters and accessories.
   2. Domestic hot water circulation pump.

1.02 REFERENCES

A. ANSI/ASME Section 8D - Pressure Vessels.
B. ANSI/NFPA 30 - Flammable and Combustible Liquids Code, latest edition.
C. ANSI/NFPA 70 - National Electrical Code, latest edition.
D. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water heaters.

1.03 QUALITY ASSURANCE

A. Plumbing Certification: Persons performing plumbing work shall have a current State Plumbing license.
B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
   1. National Sanitation Foundation (NSF).
   2. American Society of Mechanical Engineers (ASME).
   3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
   4. National Electrical Manufacturers' Association (NEMA).
   5. Underwriters Laboratories (UL).
D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25 percent of midpoint of published maximum efficiency curve.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable City codes and ordinances.
B. Conform to AGA and NSF ANSI Z21.10.3, ETL, FM and Low NOx requirements for water heaters.
C. Conform to ANSI/ASME Section 8D for tanks.

1.05 SUBMITTALS

A. Submit product data in accordance with Division 01 and Section 22 00 10.
B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
C. Include heat exchanger dimensions, size of tappings, and performance data.
D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.
E. Indicate pump type, capacity, power requirements, and affected adjacent construction.
F. Submit pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
G. Submit manufacturer's installation instructions of all equipment and accessories in accordance with Division 01 and Section 22 00 10.
H. Submit certificates as listed below to Architect in accordance with Division 01 and Section 22 00 10.
   1. ASME Coded Tank Certificate - Pressure Vessels.
   2. Test Certificates of Approval for plumbing equipment.
   3. Demonstration Certificates of Completion for all plumbing equipment.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data in accordance with Division 01 and Section 22 00 10.
B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.07 WARRANTY

A. Provide 15 year manufacturer's tank and heat exchanger warranty for domestic water heaters in accordance with Division 01 and Section 22 00 10.

PART 2 PRODUCTS

2.01 DOMESTIC WATER HEATERS AND ACCESSORIES

A. Electric Water Heaters (Direct Fired)
   1. Domestic water heater: ASHRAE 90.1 energy efficient, commercial electric vertical type, interior lined tank, anode protection, drain valve, ASME safety relief valve, high-temperature cut-off (set at 200°F or 20°F above operating thermostat maximum), operating immersion thermostats (adjustment range 120°F thru 180°F), insulated tank, baked enamel exterior steel jacket, tank inspection port, fused elements, low water cut-off, and UL approved and 150 psi working pressure ASME coded tank. Provide 3-year tank warranty.
      a. Acceptable Manufacturers and Models:
         1) State SB6 Series
         2) AO Smith DSE Series
         3) PVI G Series
         4) Rheem EG Series
         5) Lochinvar HS Series
         6) Bradford White CEA Series

2.02 WATER HEATING SYSTEM ACCESSORIES:

A. Circulation pumps: Inline type, flanged connections, rated for 125 psi at 220°F, single stage, vertical split case, all bronze or stainless steel and provided with oil cups. See Schedule for capacity.
   1. Acceptable Manufacturers:
      a. Bell & Gossett
      b. Armstrong
      c. Taco
      d. Grundfos

B. Thermostatic control for circulation pumps: Heavy-duty snap-acting SPDT switch, copper constructed liquid filled capillary and bulb sensing element, 100 to 210°F set point adjustment range, 5 to 15°F adjustable differential, 120 VAC, UL listed.
   1. Acceptable Manufacturer and Model:
      a. Barber-Colman Company TC-4112

C. Expansion Tank for Water Heater: Bladder type, full acceptance, fabricated steel shell with stainless steel connector, FDA approved removable bladder, listed by IAPMO, certified to ANSI/NSF 61, 150 psi max. working pressure, 200°F operating temperature. Pre-charge tank to static pressure of system.
   1. Acceptable Manufacturer and Model:
      a. ELBI DTS Series
      b. Amtrol STC Series
      c. Watts PLT Series
      d. Approved equal.

2.03 PIPING SPECIALTIES

A. Provide piping specialties in accordance with Section 22 11 19.

2.04 PLUMBING SUPPORTS AND ANCHORS

A. Provide supports and anchors in accordance with Section 22 05 29.

2.05 PLUMBING METERS AND GAUGES

A. Provide meters and gauges in accordance with Section 22 05 19.

2.06 PLUMBING INSULATION

A. Provide mechanical insulation in accordance with Section 22 07 16.

2.07 PLUMBING IDENTIFICATION

A. Provide mechanical identification of all equipment in accordance with Section 22 05 53.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment and accessories in accordance with manufacturer's recommendations.

B. Coordinate heating hot water and electrical work to achieve operational system.

C. Pipe relief valves and drains to nearest floor drain. Provide 1 in. air gap.
D. Install plumbing equipment plumb and square to wall on a 4 in. thick reinforced concrete housekeeping pad.
E. Provide all interconnecting electrical power and control wiring from control panel to equipment and accessories for a complete operable system. All exposed wiring shall be in conduit.
F. Secure control panels, pump and mixing valve to walls and brackets for proper operation.
G. Coordinate exact location of water heater to insure all required clearances are maintained.

3.02 TESTING

A. Contractor and Manufacturer's Representative shall test water heaters and water softeners including all associated accessories and controls to ensure proper operation.
B. Contractor shall test circulation pumps including all associated accessories and controls to ensure proper operation.
C. Tests shall be witnessed and approved by the Owner.
D. After completion and approval of testing, submit "Test Certificate of Approval" for water heaters and circulation pumps including all associated accessories and controls stating that all test results are satisfactory. Certificates of Approval must be signed by the Contractor, Manufacturer's Representative (if required), and Owner.

3.03 DEMONSTRATION OF EQUIPMENT

A. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of all the plumbing equipment and associated accessories and controls installed under this section other than the equipment listed above.
B. After completion and approval of demonstrations, submit "Demonstration Certificate of Completion" for domestic water heaters including all associated accessories and controls stating that the demonstration of all equipment is satisfactory. Certificates must be signed by the Contractor and Owner.

END OF SECTION 22 30 00

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of Plumbing Fixture Work required by this section is indicated on Drawings and Schedules, and by requirements of this section.
B. Types of plumbing fixtures specified in this section include the following:
   1. Water closets.
   2. Lavatories.
   3. Sinks.
   4. Showers.
   5. Electric water coolers.
   6. Mop sinks.
   7. Flush Valves.
   8. Plumbing Brass.
   9. Wall Hung Fixture Carriers.

1.02 REFERENCES

A. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
B. ANSI A112.19.2 - Vitreous China Plumbing Fixtures.
C. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
D. ANSI A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
E. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
F. All fixtures shall comply with ANSI/NSF STD 61.

1.03 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.
B. Fixtures: By same manufacturer throughout.
C. Trim: By same manufacturer throughout.

1.04 REGULATORY REQUIREMENTS

A. Conform to the most recent editions of the City codes and ordinances.
B. Conform to Article 7/601b. - Vernon's Texas Civil Statutes (Texas Accessibility Standards (TAS)).

1.05 SUBMITTALS

A. Submit product data in accordance with Division 01 and Section 22 00 10.
B. Include fixtures, sizes, utility sizes, trim, and finishes.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data in accordance with Division 01 and Section 22 00 10.
B. Include fixture trim exploded view and replacement parts lists.

1.07 WARRANTY

A. Provide one-year manufacturer's warranty for electric water cooler compressor in accordance with Division 01 and Section 22 00 10.

PART 2 PRODUCTS

2.01 PLUMBING FIXTURES

A. Provide plumbing fixtures as scheduled or approved equal.
B. Approved equals will be limited to the following manufacturers:
   1. Water Closets:
      a. American Standard.
      b. Kohler.
   2. Lavatories:
      a. American Standard.
      b. Kohler.
   3. Sinks:
      a. Elkay.
      b. Just.
   4. Shower Mixing Valve:
      a. Leonard.

b. Powers.
c. Symmons.
d. Bradley.

5. Electric Water Coolers (Stainless Steel Cabinet):
   a. Halsey Taylor.
   b. Elkay.
   c. Acorn Aqua.
   d. Oasis.
6. Mop Sinks:
   a. Fiat.
   b. Mustee.
   c. Swan.
   d. Stern/Williams.
7. Flush Valves;
   a. Sloan (Royal).
   b. Zurn.
   c. Kohler.
   d. American Standard.
8. Plumbing Brass:
   a. T & S Brass.
   b. American Standard.
   c. Kohler.
   d. Moen Commercial.
   e. Delta.
9. Wall Hung Fixture Carriers:
   a. Josam.
   b. J.R. Smith.
   c. Watts.
   d. Zurn.

PART 3 EXECUTION

3.01 INSPECTION

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
B. Verify adjacent construction is ready to receive rough-in work of this Section.

3.02 INSTALLATION

A. Install each fixture in accordance with the manufacturer's recommendations.
B. Piping, valves, fittings, trim, etc. shall be polished chromium plated when exposed in finished areas.
C. Piping penetrating floors, walls or ceilings shall be provided with solid polished chromium plated escutcheons.
D. Install components level, plumb, and at right angles to walls.
E. Provide floor mounted carriers for all wall mounted fixtures.
F. Install and secure fixtures in place with wall supports carriers and bolts. Exposed bolts, nuts, etc. shall be stainless steel or chrome-plated brass.
G. Seal fixtures to wall and floor surfaces with white sealant.
H. Mount fixtures to Architectural drawings interior wall elevations and to requirements of TAS.
I. Provide removable insulation covering on stops and supplies and drains and P-traps on all handicapped lavatories with hot water supply. All lavatories in rooms with handicapped water closets are considered handicapped lavatories.
J. Provide keyed stops on all water supplies to fixtures and equipment.
K. Provide water hammer arrestors on hot and cold water supplies to all plumbing fixtures. Water hammer arrestors shall be as shown on diagrams and if not shown, provide for each fixtures in accordance with Standard PDI-WH-201.

L. Provide drainage and vent piping run outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the Plumbing Code.

3.03 ADJUSTING AND CLEANING

A. Adjust and balance stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion clean plumbing fixtures and equipment.

END OF SECTION 22 40 01

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PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the basic requirements for mechanical installations, and includes requirements common to all sections of Division 23. It expands and supplements the requirements specified in Sections of Division 01.

1.02 GENERAL

A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the plumbing work in accordance with the Specifications, applicable drawings, and the conditions specified above.

B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

1.03 COMMISSIONING

A. The Contractor shall provide all System Commissioning services as required by Section C408 of the 2021 IECC. Mechanical systems shall comply with Section C403 and Electrical Power and Lighting systems shall comply with Section C405.

B. Commissioning, as outlined in Section C408 shall include the following:
   1. A Commissioning Plan
   2. Air Systems Balancing
   3. Functional Performance Testing for all Mechanical equipment, controls and economizers.
   4. Functional Performance Testing for all Lighting controls
   5. A Preliminary Commissioning Report
   6. Final Documentation including Drawings, O&M Manual, T&B Report, Final Commissioning Report.

1.04 CONSTRUCTION REQUIREMENTS

A. All work shall conform to all applicable provisions of all local, state and national authorities having lawful jurisdiction over the work.

B. Standards shall include those of the National Fire Protection Association, Underwriter's Laboratories, International Plumbing, Mechanical and Fire Codes, International Energy Code and Supplements, National Electric Code, standards of local Public Utilities, and similar authorities.

C. The above requirement shall include the Mechanical, Plumbing and Fire Codes and Ordinances of all authorities having jurisdiction in effect as of the date of the Contract documents.

D. All equipment provided and all installation methods shall meet all applicable requirements of the International Energy Code and all supplements.

E. Code-required features shall be incorporated into the finished work, whether specifically shown on the Drawings or not, and with costs included in the bid.

F. Bidders shall promptly notify the Architect of any ambiguity, inconsistency, error, or possible code violation that may become apparent during the bid period. The Architect will provide a written interpretation.

G. Verbal interpretations will not be considered as binding.

1.05 ACCESSIBILITY

A. Install equipment, materials and piping systems to provide required access for servicing, maintenance, and general inspection. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Piping systems shall not block service access of any nature, such as filter removal, equipment access panels, cleaning of tubes, and similar items.

B. Requirements for access panel sizing or distance from provided access panel shall be as follows:
   1. Minimum of 16 in. x 16 in. size when the item requiring access is less than 18 in. (radius) from center of access panel.
   2. Minimum of 24 in. x 24 in. size when the item requiring access is less than 5 ft. 0 in. and greater than 18 in. (radius) from center of access panel.

3. Minimum of 36 in. x 24 in. size when the item requiring access is greater than 5ft. 0 in. from center.

C. Locations: Provide access panels and/or doors for the following equipment, and in other locations as may be noted on the plans, or specified:

	Fire/Smoke Dampers	
	Control Dampers	
	Manual Valves	
	Trap Primers	
	Fire Dampers	
	Air Terminal Units	

D. Extend all grease fittings to an accessible location.
E. Unions and similar fittings shall not be concealed within permanent walls, or any other inaccessible location.
F. Provide access doors in accordance with requirements of Division 08.

1.06 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
B. Refer to equipment specifications in Divisions 02 through 26 for rough-in requirements.

1.07 MECHANICAL INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components.
B. Verify all dimensions by field measurements.
C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
E. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
F. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
G. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
H. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
I. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
J. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.
K. All materials, equipment and apparatus installed on the project shall be installed in strict accordance with the manufacturer's printed instructions. Where specifically noted, the manufacturer, or his authorized representative, shall certify, in writing, to the Owner, that the installation has been made in accordance with such printed requirements.
L. Pitch Pockets and Roof Penetrations:
   1. Provide special pre-fabricated penetration-type fittings for all pipes, ducts, flue pipes, etc. which pass through the roof. Such pre-fabricated fittings shall be as manufactured by Thycurb, or approved equal.
   2. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.
   3. All such fittings shall be properly flashed and counter flashed to conform to the requirements of the roofing system, or as may be approved in writing by the Architect.

4. No roof openings shall be left open overnight, but shall be provided with temporary covers until the installation is completed, and water tightness assured.
5. Pitch pockets are not acceptable.

1.08 MECHANICAL COORDINATION DRAWINGS

A. Prepare and submit a set of coordination Drawings showing major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare Drawings to an accurate scale of 1/4 in. = 1 ft. 0 in. or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining insulation, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Mechanical equipment room layouts.
   2. Exterior wall penetrations.
   3. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement.

C. Precedence:
   1. In general, piping systems that have a stated grade for proper operation shall have precedence over other systems.
   2. Precedence for pipe and duct systems shall be as follows:
      a. Building lines
      b. Structural members
      c. Soil and drain piping
      d. Vent piping
      e. Condensate piping
      f. Refrigerant piping
      g. Electrical bus duct
      h. Supply ductwork
      i. Return ductwork
      j. Exhaust ductwork
      k. Automatic Fire Protection Sprinkler Piping
      l. Domestic hot and cold water piping
      m. Electrical conduit
      n. NOTE: Lighting fixtures shall have precedence over air grilles and diffusers.

1.09 CUTTING AND PATCHING

A. This Article specifies the cutting and patching of mechanical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

B. Refer to the Division 01 Section: "EXECUTION" for general requirements for cutting and patching.

C. Refer to Division 26 Sections for requirements for cutting and patching for installation of electrical equipment, components, and materials.

D. Do not endanger or damage installed Work through procedures and processes of cutting and patching. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

E. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.

F. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

G. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work;
   2. Remove and replace defective Work;
   3. Remove and replace Work not conforming to requirements of the Contract Documents;
   4. Remove samples of installed Work as specified for testing;

5. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

H. Refer to Section 23 05 06 "Mechanical Demolition" found elsewhere in these specifications. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

J. Locate, identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover.

1.10 MECHANICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES" for submittal definitions, requirements, and procedures.

B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.

D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.

E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

1.11 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 01 Section "PRODUCTS AND SUBSTITUTION" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect/Engineer's decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

	Materials	Physical size
	Workmanship	Weight
	Gauges of Materials	Appearance
	Available Local Service Personnel	Performance
	Previous successful installations	Capacity
	Delivery Schedules	Required Equipment Clearances

C. Requests for substitutions for equipment, materials and apparatus listed in Division 23 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.

D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.
E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner, Architect, or Engineer.

1.12 PRODUCTS

A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
B. Provide products that are compatible within systems and other connected items.

1.13 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of approval agencies (U/L, PDI, ARI, NFPA, etc.) and similar essential data. Locate nameplates in an accessible location.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.15 RECORD DOCUMENTS

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for requirements. The following paragraphs supplement the requirements of Division 01.
B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.16 OPERATION AND MAINTENANCE DATA

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for procedures and requirements for preparation and submittal of maintenance manuals.
B. In addition to the information required by Division 01 for Maintenance Data, include the following information:
    1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
    2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
    3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.
5. Maintenance brochures shall be clearly marked to indicate the actual equipment model numbers, accessories, features, optional features, etc. furnished on this specific project. All equipment brochures shall reference the identifying labels used on the project Drawings.

C. Adjustment Features:
1. All items of any nature such as belt drives, damper motor linkages, pulleys, etc., and which may require adjustment shall incorporate suitable means for making such adjustments without bending, springing, or otherwise deforming any part.
2. Adjustments shall not depend upon friction alone, but shall incorporate set-screws, key-ways, lock washers, etc., for positive settings.

1.17 WARRANTIES

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
B. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
C. Provide complete warranty information for each item to include the name of the project, the date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.18 PAINTING

A. Field painting of mechanical equipment, duct systems, piping systems, etc., shall be accomplished under Division 09 of these specifications.
B. Protection of Factory-applied Finishes:
1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.
2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

1.19 CLEANING

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for general requirements for final cleaning.
B. Refer to Division 23 Section: "TESTING, ADJUSTING, AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.
C. Name Plates:
1. All nameplates shall be protected from damage during the construction process.
2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.
D. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by his work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

1.20 MOTORS AND DRIVES

A. Motors:
1. General: Motors shall be U/L-approved, with copper windings, and with a minimum Service Factor of 1.15. The nominal capacity shall exceed the brake horse-power requirements at duty schedules.
2. Motors 1/2 HP and smaller shall be 120-volt, single-phase with internal overload protection.
3. Motors 3/4 HP and larger shall be 208 -volt, 3-phase, unless scheduled or noted otherwise, and shall have thermal over-load cutouts in each phase as recommended by the motor manufacturer.
4. Motors shall be as manufactured by Century, General Electric, US Motors, Wagner, Westinghouse, or approved equal.

B. Drives:

1. Belts drives shall be rated for 150% of motor-rated horsepower.
2. Drive assemblies up to two (2) belts shall have adjustable motor sheaves with the mid-point of the adjustment range at the RPM required for the specified performance.
3. On drive assemblies with 3 or more belts, provide fixed motor sheaves for the specified RPM. Provide and install up to 2 pulley changes as necessary to achieve the required air quantities.
4. All multiple-belt drives shall be factory-marked-matched sets.

C. Specific requirements:
1. Provide high-efficiency motors for the following:
   a. Air-Handling Units, as scheduled.
   b. Ventilating Fans, as scheduled.
2. Efficiency ranges shall be as follows:

	Nominal HP	Minimum Efficiency	Premium Efficiency
	3	86.5	89.5
	5	87.5	89.5
	7.5	88.5	91.7
	10	89.5	91.7
	15	91.0	92.4
	20	91.0	93.0
	25	91.7	93.6
	30	92.4	93.6
	40	93.0	94.1
	50, 60, 75	93.0, 93.6, 94.1	94.5, 95.0, 95.4
	100	94.1	95.4

3. Motor efficiency certification shall be included with Product Submittal Data in accordance with Division 01 of these specifications.
4. Motor Starters and Controllers:
   a. Motor starters and controllers for fans, pumps, air-handling units, compressors, etc., which are not provided as an integral part of a factory-assembled package, shall be provided under Division 23 of the specifications. Refer to Section 23 89 65 "MOTOR CONTROLLERS."

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 23 00 10

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.
B. Refer to Section 21 00 10 - General Requirements for Fire Protection Work
C. Refer to Section 22 00 10 - Basic Plumbing Requirements.
D. Refer to Section 23 00 10 - Basic Mechanical Requirements.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire protection (sprinkler) system	21	21	28
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.
	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
2. Precedence for pipe, conduit and duct systems shall be as follows.
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Condensate piping
   f. Refrigerant piping
   g. Electrical bus duct
   h. Supply ductwork
   i. Return ductwork
   j. Exhaust ductwork
   k. Automatic Fire Protection Sprinkler Piping
   l. Domestic hot and cold water piping
   m. Electrical conduit
3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION 23 05 12

PART 1 GENERAL

1.01 SUMMARY

A. Extent of mechanical identification work required by this section is indicated on Drawings and/or specified in other Division 23 sections.
B. Types of identification devices specified in this section include the following:
   1. Plastic Duct Markers.
   2. Plastic Equipment Markers.
C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division 23 sections.
D. Refer to other Division 23 sections for identification requirements at central-station mechanical control center; not work of this section.
E. Refer to Division 26 sections for identification requirements of electrical work; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
B. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
   1. Allen Systems, Inc.
   2. Brady (WHO) Co.; Signmark Div.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PLASTIC DUCT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color-coded duct markers. Conform to the following color code:
   1. Yellow/Green: Supply air.
   2. Blue: Exhaust, and return air.
B. Nomenclature: Include the following:
   1. Direction of airflow.
   2. Duct service (supply, return, exhaust, etc.).

2.04 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:
   1. Green: Cooling equipment and components.
   2. Yellow: Heating equipment and components.
   3. Yellow/Green: Combination cooling and heating equipment and components.

4. Blue: Equipment and components that do not meet any of the above criteria.
5. Red: Fire protection equipment and components.
6. For hazardous equipment, use colors and designs recommended by ANSI A13.1.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
1. Name and plan number.
2. Equipment service.

C. Size: Provide approximate 2-1/2 in. x 4 in. markers for control devices, dampers, and valves; and 4-1/2 in. x 6 in. for equipment.

2.05 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification that indicates individual system number as well as service (example; HP-1:Office Area).

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, and exhaust ductwork with duct markers.

B. Location: In each space where ductwork is exposed, or concealed by removable ceiling system, locate signs near every 25 feet.

3.03 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
1. Air Conditioning Units (indoor and outdoor)
2. Fans
3. Radiant Heater

B. Optional Sign Types: Where lettering larger than 1 in. height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 1/4 in. high lettering for name of unit where viewing distance is less than 2 ft. 0 in., 1/2 in. high for distances up to 6 ft. 0 in., and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device, which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 23 05 53

PART 1 GENERAL

1.01 SUMMARY

A. Adjust and balance Mechanical Air systems
B. Check each piece of operating equipment provided under Division 23.
C. Provide Balancing Report

1.02 QUALITY ASSURANCE

A. Independent Subcontractor: All testing, adjusting and balancing shall be performed by a Testing, Adjusting and Balancing firm that is independent from the HVAC systems installer.
B. Balancing Work: Under direct supervision of AABC accredited testing organization certified supervisor.

1.03 REFERENCES

A. Reference Standards: Comply with AABC National Standards for Total System Balance, latest edition.

1.04 SUBMITTALS

A. Certificate: Before beginning work, submit certification of AABC certified supervisor and AABC firm certification in accordance with Section 23 00 10.
B. Balancing Report: At completion of work, submit balancing report in accordance with Section 23 00 10. After adjustments have been made submit three (3) copies of a complete detailed report on mechanical systems and their operation to include:
    1. Blackline prints with air openings marked to correspond with data sheets.
    2. Data sheets showing amount of air handled at each opening, instrument used, velocity readings and manufacturer free area factors.
    3. Equipment data sheets giving make, size, etc., of fans, motors and drives. Include supply fans, exhaust and recirculating fans.
    4. Operating data including fan RPM, measured motor current and voltage BHP and CFM (total).
    5. Equipment and operating data including air temperatures entering and leaving coils (maximum air temperature rise), together with corresponding air flow and air pressure drop.
    6. Equipment and operating data as required to show performance of fan coils, unit heaters, temperature control devices, pumps and domestic hot water circulating systems.
    7. A statement outlining any abnormal or notable conditions not covered in above data. Make special note of any discrepancies between tabulated data and specified conditions.

1.05 PROJECT CONDITIONS

A. Existing Conditions: Verify following conditions before proceeding with work:
    1. Installation of the designated system is complete and in full operation.
    2. Outside temperature conditions, occupant loads, lighting loads, special equipment requiring extra sensible or ventilation requirements, and solar conditions are within a reasonable range relative to design conditions.

PART 2 PRODUCTS

2.01 INSTRUMENTS

A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of AABC.
B. Calibration histories for each instrument shall be available for examination.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect preceding work in accordance with Section 23 00 10 BASIC MECHANICAL REQUIREMENTS.

3.02 PREPARATION

A. Air Systems: Check:
    1. Filters are clean.

2. Filter leakage.
3. Damper operation and leakage.
4. Duct leakage.
5. Fan rotation.
6. Equipment vibration.

3.03 ADJUSTING AND BALANCING

A. General: Check, adjust and balance air and water system to meet the design performance and tabulate results on acceptable forms. Minimum data to include amperage, voltage input, and thermal heater capacity of each motor, equipment nameplate data and operating speed, pressure drop across each filter bank, pressure rise across each fan and pump, CFM capacity each outlet, zone and fan, and heating or cooling capacity of each coil or element.

B. Belt Drives: Adjust so that when the desired speed and belt tension had been established, the variable speed pulley and the belt tension adjustment shall be at approximately the midpoint of their range.

C. Water Balance and Equipment Test to include domestic hot water heater circulating pump.

D. Air Systems:
   1. Adjust dampers, diffusers, registers, and sheaves for the delivery and distribution of air quantities indicated on the drawings.
   2. Mark balancing device at final setting.
   3. Replacement of adjustable pulleys, installation of additional balancing dampers or pressure taps, required to effect proper air balance shall be furnished and installed by the HVAC Contractor at no additional cost to the Owner.
   4. Adjust exhaust and recirculation air systems for air quantities indicated on drawings and to establish the proper relationship between supply and exhaust.
   5. Adjust distribution system to obtain uniform space temperature free from objectionable drafts and noise within the capabilities of the system.
   6. Acceptable Tolerances: Adjust fan systems, air devices, etc. as follows:
      a. Supply air fan CFM: -5% to +5% of scheduled
      b. Return air fan CFM: -5% to +5% of scheduled
      c. Exhaust air fan CFM: -0% to +10% of scheduled
      d. Supply air device CFM: -0% to +10% of scheduled
      e. Return air device CFM: -10% to +0% of scheduled
      f. Exhaust air device CFM: -0% to +10% of scheduled

E. Test Run: In order to determine that the system installation is complete and will operate satisfactorily, make a test run with equipment operating per normal temperature control schedule and sequence. Run test and operate and adjust equipment as may be required during test run. Test all air conditioning equipment in both heating and cooling modes.

3.04 COMPLETION SERVICES

A. Final Check: Make final checks and do any rebalancing as directed.

B. Report: Submit Balancing Report as specified above.

C. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. Owner reserves the right to spot check the report by field verification prior to final acceptance.

END OF SECTION 23 05 93

PART 1 GENERAL

1.01 SUMMARY

A. Extent of mechanical insulation required by this section is indicated on Drawings and schedules, and by requirements of this section.
B. Types of mechanical insulation specified in this section include the following:
   1. Ductwork System Insulation:
      a. Fiberglass.
C. Refer to Section 23 31 13 "METAL DUCTWORK" for duct linings; not work of this section.
D. Refer to Section 23 05 53 "MECHANICAL IDENTIFICATION" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
C. Flame/Smoke Ratings: Provide composite mechanical (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Armstrong World Industries, Inc.
   2. Babcock & Wilcox; Insulating Products Div.
   3. Manson.
   4. Knauf Fiber Glass.
   5. Johns Manville Products Corp.
   6. Owens-Corning Fiberglass Corp.

2.02 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1.
B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4.
C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Thickness of insulation shall be as recommended by the manufacturer for the temperatures and pipe sizes involved, and in accordance with standards of T.I.M.A.

3.02 DUCTWORK SYSTEM INSULATION

A. Insulation Omitted: Do not insulate lined ductwork.

B. Dual Temperature Ductwork:

1. Application Requirements: Insulate the following dual temperature ductwork:
    a. Hot/cold supply and return ductwork between fan discharge or HVAC unit discharge and room terminal outlets.
    b. Insulate necks and bells of supply diffusers.
    c. Outside air ductwork to fan/coil units.
2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
    a. Rigid Fiberglass: 2 in. thick in machine, fan and equipment rooms.
    b. Flexible Fiberglass: 2.2 in. thick (R-6), application limited to concealed locations. Flexible insulation will not be used in machine, fan and equipment rooms.

3.03 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Corner Angles: Except for oven and hood exhaust duct insulation; install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.04 PROTECTION AND REPLACEMENT

A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture-saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 07 13

PART 1 GENERAL

1.01 SUMMARY

A. Extent of refrigerant piping work is indicated on drawings and schedules, and by requirements of this section. This section pertains to the Animal Shelter VRF System only.

B. This section includes pipe, fittings and valves for refrigerant piping systems installed in the project.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of refrigerant piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with refrigerant piping work similar to that required for project.

C. Comply with manufacturer's installation instructions for VRF piping.

D. Codes and Standards:

1. ANSI Compliance: Fabricate and install refrigerant piping in accordance with ANSI B31.5 "Refrigeration Piping", and extend applicable lower pressure limits to pressures below 15 psig.
2. UMC Compliance: Fabricate and install refrigerant piping in accordance with IAPMO "Uniform Mechanical Code".
3. IMC Compliance: Fabricate and install refrigerant piping in accordance with “International Mechanical Code.”
4. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping materials and products.

B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ANSI B31.5).

C. Shop Drawings: Submit scaled layout drawings of refrigerant pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

D. Record Drawings: At project closeout, submit record drawings of installed refrigerant piping and piping products, in accordance with requirements of Division 01.

E. Maintenance Data: Submit maintenance data and parts lists for refrigerant piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in refrigerant piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.02 BASIC PIPES AND FITTINGS

A. Refrigeration Piping:

1. Tube Size 4-1/8 in. and Smaller: ASTM B280, copper tube; Type ACR, hard-drawn temper; ANSI B16.22, wrought-copper, solder-joint fittings; brazed joints.

2. Tube Size 3/4 in. and Smaller: ASTM B280, copper tube; Type ACR, soft annealed temper; fittings, cast copper-alloy fittings for flared copper tubes; flared joints.
3. Tube Size 7/8 in. through 4-1/8 in.: ASTM B280, copper tube; Type ACR, soft annealed temper; ANSI B16.22, wrought-copper, solder-joint fittings; brazed joints.
4. Refrigerant piping for VRF systems can be comprised of both soft copper or hard-drawn copper. If soft copper is utilized, it will be restricted to concealed areas. All areas inside and outside the building within view and including mechanical rooms shall be restricted to hard-drawn copper.

B. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

2.03 SPECIAL REFRIGERANT VALVES

A. General: Special valves required for refrigerant piping include the following types:
1. Globe and Check Valves:
a. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300°F (149°C) temperature rating, and 500 psi working pressure.
b. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F (121°C) temperature rating, and 500 psi working pressure.
c. Manufacturer: Subject to compliance with requirements, provide globe and check valves of one of the following or approved equal:
1) Henry Valve Co.
2) Parker Hannifin Corp.; Refrigeration & Air- Cond. Div.
3) Sporlan Valve Co.
2. Solenoid Valves:
a. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, Teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, 1/2 in. conduit adapter, 250°F (121°C) temperature rating, 400 psi working pressure.
1) Manual Operator: Provide manual operator to open valve.
b. Manufacturer: Subject to compliance with requirements, provide solenoid valves of one of the following or approved equal:
1) Alco Controls Div.; Emerson Electric Co.
2) Automatic Switch Co.
3) Sporlan Valve Co.

2.04 REFRIGERANT SPECIALTIES

A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 psi working pressure.
B. Moisture-Liquid Indicators: Forged brass, single port, removable caps, polished optical glass, solder connections, UL-listed, 200°F (93°C) temperature rating, 500 psi working pressure.
C. Refrigerant Filter-Driers: Steel shell, ceramic-fired desiccant core, solder connections, UL-listed, 500 psi working pressure.
D. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
E. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
F. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.
G. Manufacturer: Subject to compliance with requirements, provide refrigeration accessories of one of the following or approved equal:
1. Alco Controls Div.; Emerson Electric Co.
2. Henry Valve Co.
3. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Div.
4. Sporlan Valve Co.

PART 3 EXECUTION

3.01 INSPECTION

A. General: Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF REFRIGERANT PIPING

A. Install refrigerant piping with 1/4 in. per ft. (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.

B. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.

C. Bleed dry nitrogen through refrigerant piping during brazing operations.

D. All pipes shall be supported from the building structure in a neat a workmanlike manner, and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted. Spacing of pipe supports shall not exceed 6 ft. for pipes up to 1-1/4 in. and 10 feet on all other piping. Hanger shall pass around the insulation and an 18 gage steel protective band, 12 in. long, shall be inserted between the hangers and the insulation.

E. Insulation material shall be ½ in. thick for all pipe sizes up to 1 in. and 1 in. thick for all pipe sizes of 1 in. Insulation shall be flexible closed cell foam equal to ArmaFlex by Armacell or approved equal. All refrigerant suction piping shall be insulated. Pipe insulation shall have a flame spread rating of not over 25, 50 smoke developed and 50 fuel contributed. Verify insulation requirements with code when installed in return air plenum spaces.

F. All pipe insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together. All fittings shall be insulated and finished in strict accordance with manufacturer’s recommendations. Insulation exposed to weather shall have waterproof and UV resistant covering equal to ArmaFlex Shield by Armacell.

G. Piping shown to be routed underground shall be contained within PVC piping sleeve.

3.03 INSTALLATION OF SPECIAL REFRIGERANT VALVES

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing, replace after joints are completed.

1. Solenoid Valves: Install in refrigerant piping as indicated with stem pointing upwards.
    a. Wiring of solenoid valves is specified in applicable Division 26 sections, and is included as work of this section.
    b. Wiring of solenoid valves is specified in applicable Division 26 sections; not work of this section.

3.04 INSTALLATION OF REFRIGERANT ACCESSORIES

A. Refrigerant Strainers: Install in refrigerant lines as indicated, and in accessible location for service.

B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines, in accessible location.

C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated, and in accessible location for service.

D. Evaporator Pressure Regulators: Install in refrigerant suction lines or evaporator outlets as indicated. Adjust, if required, for proper evaporator pressure.

E. Refrigerant Discharge Line Mufflers: Install as indicated, in horizontal or down flow portion of hot-gas lines, immediately after leaving compressor; not in riser.

3.05 EQUIPMENT CONNECTIONS

A. General: Connect refrigerant piping to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.06 FIELD QUALITY CONTROL

A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27 in. vacuum, and then 200 psi using halide torch. System must be entirely leak-free.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

C. Provide written report to the Architect outlining results from pressure tests for each installed refrigerant system.

3.07 DEHYDRATION AND CHARGING SYSTEM

A. Install core in filter dryer after leak test but before evacuation.

B. Evacuate refrigerant system with vacuum pump; until temperature of 35°F (2°C) is indicated on vacuum dehydration indicator.

C. During evacuation, apply heat to pockets, elbows, and low spots in piping.

D. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.

E. Break vacuum with refrigerant gas; allow pressure to build up to 2 psi.

F. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.08 ADJUSTING AND CLEANING

A. Cleaning and Inspecting: Clean and inspect refrigerant piping systems.

END OF SECTION 23 23 00

PART 1 GENERAL

1.01 SUMMARY

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork accessories required for project include the following:
   1. Dampers.
      a. Low-pressure manual dampers.
      b. Control dampers.
      c. Counterbalanced relief dampers.
   2. Turning vanes.
   3. Duct hardware.
   4. Flexible connections.
   5. Concealed Damper Regulators.

C. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:
   1. SMACNA Compliance: Comply with applicable portions of SMACNA “HVAC Duct Construction Standards, Metal and Flexible,” 2005 edition.
   2. Industry Standards: Comply with latest ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
   3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 “Fire Dampers and Ceiling Dampers.”
   4. NFPA Compliance: Comply with applicable provisions of NFPA 90A latest edition “Installation of Air Conditioning and Ventilating Systems”, pertaining to installation of ductwork accessories.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

B. Shop Drawings: Submit manufacturer’s assembly type Shop Drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

C. Maintenance Data: Submit manufacturer’s maintenance data including parts lists for each type of duct accessory. Include this data, product data, and Shop Drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 PRODUCTS

2.01 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi blade type, constructed in accordance with SMACNA “HVAC Duct Construction Standards.”

B. Control Dampers: Provide dampers with parallel blades for 2-position control, or opposed blades for modulating control. Construct blades of 16-ga steel; provide heavy-duty molded self-lubricating nylon bearings, 1/2 in. diameter steel axles spaced on 9 in. centers. Construct frame of 2 in. x 1/2 in. x 1/8 in. steel channel for face areas 25 sq.ft. and under; 4 in. x 1-1/4 in. x 16-ga channel for face areas over 25 sq.ft. Provide galvanized steel finish with aluminum touch up.

C. Control Dampers: Refer to Division 23 Section “CONTROL SYSTEMS”: for control dampers; not work of this section.

D. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
   1. Air Balance, Inc.
   2. Nailor

3. American Warming & Ventilating, Inc.
4. Louvers & Dampers, Inc.
5. Penn Ventilator Co.
6. Ruskin Mfg. Co.

2.02 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Turning Vanes: Turning vanes shall be double wall turning vanes fabricated from the same material as the duct. Tab spacing shall be SMACNA standard. Rail systems with non-standard tab spacings shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert tabs that align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs when fastened per the manufacturer's instructions.

C. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of air-foil shaped aluminum extrusions with perforated faces and fiberglass fill.

D. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
   1. Aero Dyne Co.
   2. Anemostat Products Div.; Dynamics Corp. Of America
   3. Barber-Colman Co.
   4. Ductmate Industries, Inc.
   5. Duro Dyne Corp.
   6. Hart & Cooley Mfg. Co.
   7. Register & Grille Mfg. Co., Inc.

2.03 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
   1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
   2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 in. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
   1. Ventfabrics, Inc.
   2. Young Regulator Co.

2.04 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections wherever ductwork connects to vibrating equipment. Construct flexible connections of neoprene coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
   1. American/Elgen Co,; Energy Div.
   2. Ductmate Industries
   3. Duro Dyne Corp.
   4. Flexaust (The) Co.
   5. Ventfabrics, Inc.

2.05 CONCEALED DAMPER REGULATORS: FOR VOLUME DAMPERS LOCATED ABOVE GYP BOARD, PLASTER OR OTHER HARD CEILINGS:

A. Concealed damper regulators shall be designed to control volume dampers from the ceiling line. Regulators shall be imbedded so the entire unit is flush with the finished surface. The regulator cover plate shall cover the joint between the box and the ceiling. The cover shall be adjustable from 1/2 in. to 1-1/8 in. utilizing the manufacturer's spanner wrench. Coverplate to have zinc plated finish, suitable for painting. Concealed damper regulators to be Young Regulator Model 315.

B. Volume dampers for concealed damper regulators shall be Young Regulator Model 5020-B (round) or Model 820A-C (rectangular), designed and installed for operation by ceiling mounted regulators.
C. Where required, provide Young Regulator Model 927 Right Angle Miter Gears, or Model 1200 Right Angle Worm Gear Regulator, to allow control of a damper that has the damper shaft perpendicular to the shaft from the ceiling mounted damper regulator.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
B. Install turning vanes in square or rectangular 90° elbows in supply, return and exhaust air systems, and elsewhere as indicated.
C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.03 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
    1. Label access doors in accordance with Division 23 Section "MECHANICAL IDENTIFICATION".
    2. Final positioning of manual dampers is specified in Division 23 Section "TESTING, ADJUSTING AND BALANCING".
B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 31 13.19

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
B. All duct dimensions shown on drawings are net inside clear dimensions.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
C. Codes and Standards:
    1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", First Edition, 2005, for fabrication and installation of metal ductwork.
    2. ASHRAE Standards: Comply with ASHRAE Handbook latest edition, HVAC Systems and Equipment volume, Chapter 16 "Duct Construction", for fabrication and installation of metal ductwork.
    3. NFPA Compliance: Comply with latest editions of NFPA 90A "Installation of Air Conditioning and Ventilating Systems" and NFPA 90B" Installation of Warm Air Heating and Air Conditioning Systems".
D. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
E. Flame/Smoke Ratings: Provide composite mechanical system (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.
B. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials and rigidity are not reduced.
C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.
D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 PRODUCTS

2.01 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials that are free from visual imperfections including pitting, seam marks, roller marks, and stains and discolorations, and other imperfections, including those that would impair painting.

B. Stainless Steel Sheet (Outside Building Envelope): Where indicated, provide stainless steel complying with ASTM A167; Type 302, 304, or 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

C. Sheet Metal: All interior ducts shall be constructed with G-60 or better galvanized steel (ASTM A 653/A 653M) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (i.e. moisture laden exhausts not specified to be stainless steel) shall be G-90 or better galvanized steel LFQ, chem treat.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.

C. Duct Liner:
   1. Fibrous glass, complying with Thermal Insulation Manufacturer's Association (TIMA) AHC-101; of thickness indicated with a minimum installed R-Valve equal to 5 (1-1/2 in. thick minimum), with black-coated, fire-resistant airstream face, with EPA-registered antimicrobial agent.
   2. Manufacturers:
      a. Certainteed "Toughgard".
      b. Knauf Type "EM".
      c. Johns Mansville "Permacote Linacoustic".
      d. Owens-Corning "Aeroflex Plus".
      e. No Substitutions

D. Duct Liner Adhesive:
   1. Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation." Application shall conform to Manufacturer's written recommendations for the apparent application.
   2. Adhesives shall be non-inflammable after curing.
   3. Manufacturers:
      a. Benjamin-Foster.
      b. Duro Dyne "FPG".
      c. Kinco 15-137.
      d. Miracle PF-91.
      e. Manufacturer of duct liner used for this project.

E. Duct Liner Fasteners:
   1. Comply with SMACNA "Installation Standards for Rectangular Ducts using Flexible Liner", Articles S2.0 through S2.11.
   2. Comply with lining details as shown in the referenced SMACNA Section, Figures 2-22 and 2-23.
   3. Clinched-pin type fasteners shall be "Grip-Nail", or approved equal.
   4. Projecting pins in Type 3 or Type 4 applications shall be clipped off close enough to the retaining disc to provide proper anchoring and to prevent injury to personnel.

F. Duct Sealant:
   1. Duct sealer shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall seal out water, air, and moisture. Sealer shall be UL listed and conform to ASTM E 84.
   2. Comply with requirements of SMACNA Table 1-2.
   3. Manufacturers:
      a. Benjamin-Foster
      b. Ductmate - PROseal.
      c. Duro Dyne S2.
      d. Hardcast.
      e. United Sheet Metal.

G. Duct Cement:
   1. Non-hardening, non-migrating mastic or liquid elastic sealant of type applicable for fabrication/installation detail as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
   2. Comply with requirements of SMACNA Table 1-2.
   3. Manufacturers:
      a. Benjamin-Foster.
      b. Duro Dyne S2.
      c. Hardcast.
      d. United Sheet Metal.

H. Ductwork Support Materials:
   1. General:
      a. Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
      b. Comply with applicable provisions of SMACNA 2005 Standards, Figures 4-1 through 4-8, and Tables 4-1 through 4-3.
   2. Except where space is indicated as “High Humidity” area, interior support materials of not less than 1/4 in. diameter or 3/16 in. thickness may be plain (not galvanized).
   3. For exposed stainless steel ductwork, provide matching stainless steel support materials.

2.03 FLEXIBLE DUCTS

A. General:
   1. Either spiral wound spring steel with flameproof vinyl sheathing, or corrugated aluminum; complying with UL181.
   2. Comply with applicable provisions of SMACNA 2005 Standards, pages 3-13 through 3-20.
   3. Installation shall conform to conditions under which UL listing was granted.

B. Insulation:
   1. Insulate all flexible ducts, both supply and return, with a minimum R-Value of 5.0, per International Energy Conservation Code – latest edition. Duct shall have a continuous flexible fiberglass sheath with UL approved vinyl barrier jacket.

C. Manufacturers: Subject to compliance with requirements, provide flexible ducts manufactured by one of the following:
   1. ATCO.
   2. Genflex.
   3. Thermaflex.

2.04 FABRICATION

A. Shop-fabricate ductwork in 4,8,10, or 12 ft. lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match mark sections for reassembly and coordinated installation.

B. All duct dimensions shown on drawings are net inside clear dimensions.

C. Shop-fabricate ductwork of gauges and reinforcement complying with SMACNA 2005 Standards as follows:
   1. Rectangular, Steel:
      a. Tables 1-1 through 1-13.
      b. Figures 1-2 through 1-18.
      c. Fittings and Construction, Section II.
   2. Rectangular, aluminum: Pages 1-31 through 1-33.
   3. Round, Oval and Flexible Duct: Section III.

D. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Handbook, HVAC Systems and Equipment Volume, Chapter 16 “Duct Construction”.

E. Longitudinal Seams: Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.

F. Ductmate or W.D.C.I. proprietary duct connection systems will be acceptable. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.

G. Formed on flanges (T.D.C./T.D.F./T-25A/T-25B) will only be acceptable when submitted for approval prior to installation of any ductwork. Formed on flanges will be constructed as SMACNA T-25 flanges, whose limits are defined on Page 1.36 of the 2005 SMACNA Manual, First Edition. No other construction pertaining to form on flanges will be acceptable. Formed on flanges shall be acceptable for use on ductwork 42 in. wide or less, with 2 in. positive pressure static or less, and must include the use of corners, bolts and cleat.

H. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

I. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 Section “Ductwork Accessories” for accessory requirements.

J. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners. Comply with previous paragraph 2.2.

K. Round Duct Joints:
   1. 0 in. - 20 in. diameter, interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint before assembling and after fastening. Wrap joints with 3 in. wide duct tape.
   2. 21 in. - 72 in. diameter, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.

L. Pressure Classifications:
   1. Static pressure ratings for ductwork systems shall be as noted on the drawings, and/or shall conform to requirements of 2005 SMACNA Standards, Table 1-1.
   2. In no case shall the pressure rating of the duct be less than that indicated in Table 1-1 for the apparent duct velocity.
   3. Gauges of metal and reinforcing methods shall conform to SMACNA requirements as follows:
      a. Rectangular Steel: Table 1-3 through 1-13.
      b. Rectangular Aluminum: Tables 1-14 through 1-16.
      c. Round, or Flat Oval, Steel: Table 3-2.
      d. Round Aluminum: Table 3-3.

2.05 FACTORY-FABRICATED DUCTWORK

A. At Contractor’s option, factory-fabricated ductwork sections, fittings, etc., may be substituted for shop-made items.

B. Factory-fabricated items shall comply in every respect with SMACNA requirements listed previously in this Section, or show proof from a recognized, approved independent laboratory, prior to bidding, that the proposed construction methods produce products that equal, or exceed, the SMACNA 2005 Standards.

C. Comply with applicable provisions of Fort Worth Mechanical Code.

D. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork and/or fittings of one of the following:
   1. Ductmate, Inc., Monongahela, PA.
   2. Semco Mfg., Inc.
   3. United Sheet Metal Div., United McGill, Inc.

PART 3 EXECUTION

3.01 INSPECTION

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3 in. and under; 1% for systems rated over 3 in.) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8 in. misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type that will hold ducts true to shape and to prevent buckling. Support vertical ducts at every floor. Seal all longitudinal and transverse duct joints and seams with non-hardening duct mastic.

B. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop fabricated work and accommodates installation requirements.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Where possible, locate insulated ductwork for 1 in. clearance outside of insulation. Limit clearance to 1/2 in. where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with structural members, suspended ceiling, lighting layouts, sprinkler piping, plumbing systems and similar finished work.

E. Electrical Equipment Spaces: Do not route ductwork through Electric Rooms, transformer vaults, and other electrical equipment spaces and enclosures.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2 in. Fasten to duct and substrate.

1. Where ducts pass through fire rated floors, walls, or partitions, provide fire stopping between duct and substrate, in accordance with requirements of Division 07 Section “FIRE STOPPING”.

G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF DUCT LINER

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards, pages 2-25 thru 2-29.

B. All supply and return ductwork serving FAN/COIL units shall be lined with 1-1/2 in. thick acoustical lining for 10 feet from the unit.

C. All supply and exhaust ductwork outside the building (and stubbed into the mechanical room) shall be lined with 2" thick (R-8) acoustical lining.

3.04 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6 feet extended length. Flex duct shall not be used for elbows or changes in direction.

B. Installation: Install in accordance with Section III of SMACNA’s, HVAC Duct Construction Standards, Metal and Flexible”.

3.05 FIELD QUALITY CONTROL

A. Leakage Tests: After installation of each duct system that is constructed for duct classes over 3 in. is completed, test for duct leakage. Repair leaks and repeat tests until total leakage is less than 1% of system design airflow.

B. The testing shall be performed as follows:

1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.

2. Use a certified orifice tube for measuring the leakage.
3. Define section of system to be tested and blank off.
4. Determine the percentage of the system being tested.
5. Using that percentage, determine the allowable leakage (CFM) for that section being tested.
6. Pressurize to operating pressure and repair any significant or audible leaks.
7. Repressurize and measure leakage.
8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

3.06 EQUIPMENT CONNECTIONS

A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.07 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until time connections are to be completed.

D. Balancing: Refer to Division 23 Section “TESTING, ADJUSTING AND BALANCING” for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION 23 31 13

PART 1 GENERAL

1.01 SUMMARY

A. Extent of fan work required by this section is indicated on Drawings and schedules, and by requirements of this section.

B. Types of centrifugal fans required for project include the following:
   1. Centrifugal Roof and Wall Exhausters.

C. Refer to Section 23 05 12 - "MECHANICAL AND ELECTRICAL COORDINATION" for responsibility of electrical work. Electrical work required of Division 23 shall be done in compliance with requirements of Division 26 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of centrifugal fans, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. Codes and Standards:
   1. AMCA Compliance: Provide centrifugal fans bearing the AMCA Certified Ratings Seal. Sound rate centrifugal fans in accordance with AMCA 300 "Test Code for Sound Rating Air Moving Devices".
   2. AMCA Compliance: Provide axial fans bearing the AMCA Certified Ratings Seal.
   3. ASHRAE Compliance: Test and rate centrifugal fans in accordance with ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating", latest edition.
   4. UL Compliance: Provide centrifugal fan electrical components that have been listed and labeled by UL.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gauges and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.

B. Shop Drawings: Submit assembly-type shop Drawings showing fan dimensions, required clearances, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data, product data; shop Drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of Division 01.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handle fans carefully to avoid damage to components, enclosures, and finish. Do not install-damaged components; replace and return damaged components to centrifugal fan manufacturer.

C. Store fans in clean dry place and protect from weather and construction traffic.

D. Comply with manufacturer's rigging and installation instructions for unloading fans, and moving them to final location.

PART 2 PRODUCTS

2.01 CENTRIFUGAL ROOF EXHAUSTERS

A. General: Provide roof exhaust fans of the centrifugal, belt-driven or direct-driven type and of capacities and having accessories as scheduled.

B. Housing: Construction of the fan housing shall be of heavy gauge aluminum. All spun parts shall have a rolled bead for added rigidity and shall be specially spun so as to seal the pores of the aluminum.

C. Fan Wheel: The fan wheel shall be all aluminum of the centrifugal blower type with backward inclined blades and a tapered inlet shroud. Wheels shall be statically and dynamically balanced. Inlet cone shall be aluminum.
D. Motor and Drive: Motor and drives shall be enclosed in a weathertight compartment, separate from the exhaust airstream. Air for cooling the motor shall be supplied to the motor compartment by way of an air passage, from an area free of contaminated exhaust fumes. Motors shall be of the heavy duty, permanently lubricated, and sealed ball bearing type. Drives shall be sized for 165 percent of motor horsepower capabilities and of the cast iron type, keyed to the fan and motor shafts. Variable pitch drives shall be standard. Fan shaft shall be of steel construction, turned, ground and polished to precise tolerances in relationship to the hub and bearings. Drive belts shall be of the oil-resistant, non-static, and non-sparking type with life expectancy of over 24,000 hours. The entire drive assembly and wheel shall be removable, as a complete unit, from the support structure without disassembling the external fan housing. The complete drive assembly shall be mounted on rubber vibration isolation. Direct drive units shall be of identical construction as belt drive units, except for drives, belts, and fan shaft bearings.
E. Bearings: Bearings shall be flanged and of the permanently lubricated, permanently sealed, ball bearing type capable of over 200,000 hours bearing life.
F. Manufacturer: Subject to compliance with requirements, provide centrifugal roof exhaust fans of one of the following:
    1. Greenheck.
    2. Loren Cook Co.

2.02 PREFABRICATED ROOF CURBS

A. General: Provide manufacturer's standard shop fabricated units, modified if necessary to comply with requirements.
B. Fabricate structural framing for units of structural quality sheet steel (ASTM A 570, Grade 40), formed to profiles indicated or, if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation and deck construction. Include 45° cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units.
    1. Clean and paint units with manufacturer's standard rust inhibitive metal primer paint.
    2. Fabricate units from zinc-coated steel, ASTM A 446, Grade C, designation G90 hot dip coating, mill phospatized. Clean and paint with rust inhibitive metal primer paint, of type recommended by manufacturer, 2.0 mils dry film thickness.
C. Reinforce continuous runs of over 3 ft. 0 in. length, by inserting welded stiffeners of heavy gauge with flanges as required to provide sufficient rigidity and strength to withstand maximum lateral forces in addition to superimposed vertical loads.
D. Sloping Roof Decks: For deck slopes of 1/4 in. per ft. and more, fabricate support units to form level top edge.
E. Gauge and Height: Fabricate units of metal gauge and to height above roof surface as indicated.
    1. Where gauge or heights are not indicated, fabricate units of 14-gauge metal, and nominal height of 14 in.
F. Provide treated wood nailer, not less than 1 5/8 in. thick and of width indicated, but not less than width of support wall assembly. Anchor nailer securely to top of metal frame unit.
G. Provide lumber pressure treated with water borne preservatives for "above ground" use, complying with AWPB LP-2.
H. Fabricate exterior support profile to receive insulation of thickness indicated or, if not indicated, of 1 in. thickness.
I. Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3 lb. Density and 1-1/2 in. minimum thickness, except as otherwise indicated.
J. Metal Deck Reinforcement: Where indicated as integral part of support units, provide channel shaped metal deck closure strips to reinforce opening through metal decking. Fabricate strips from 14-ga metal to match construction and finish of curb units, except as otherwise indicated.
K. Manufacturer: Subject to compliance with requirements, provide prefabricated roof curbs of one of the following:
    1. Pate Co.
    2. S & L Manufacturing Co.

3. ThyCurb Div.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FANS

A. General: Install fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that fans comply with requirements and serve intended purposes.

B. Access: Provide access and service space around and over fans as required, but in no case less than that recommended by manufacturer.

C. Isolation: Isolate fans with vibration isolators; fasten in accordance with manufacturer's installation instructions.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Ensure that rotation is in direction intended for proper performance. Do not proceed with fan start-up until wiring installation is acceptable to centrifugal fan Installer.

E. Ductwork Connections: Refer to Division 23 "DUCTWORK" sections. Provide flexible connections on inlet and outlet duct connections.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be satisfactorily corrected.

3.04 ADJUSTING AND CLEANING

A. Start-up, test, and adjust fans in accordance with test and balance specifications.

END OF SECTION 23 34 00

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PART 1 GENERAL

1.01 SUMMARY

A. Extent of air outlets and inlets work is indicated by Drawings and schedules, and by requirements of this section.

B. Types of air outlets and inlets required for project include the following:
   1. Ceiling return air grilles.
   2. Ceiling air diffusers.
   3. Wall registers and grilles.
   4. Linear slot diffusers
   5. Louvers.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
   2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets", latest edition.
   3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
   4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
   5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
   6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
   7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Installation of Air Conditioning and Ventilating Systems" latest edition.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
   1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
   2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
   3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop Drawings in maintenance manuals; in accordance with requirements of Division 01.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 PRODUCTS

2.01 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of aluminum, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling systems that will contain each type of ceiling air diffuser. All air devices installed in plaster, gyp board or other hard ceilings or walls shall be provided with a separate mounting frame.
D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on the air device schedule.
    1. Diffuser Finishes:
        a. Finish shall be off-white baked enamel.
E. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
    1. Metalaire,
    2. Krueger,
    3. Nailor,
    4. Price,
    5. Titus,
    6. No Substitutions.

2.02 WALL REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of wall construction that will contain each type of wall register and grille.
D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on the air device schedule.
    1. Register and Grille Finishes:
        a. Finish shall be off-white baked enamel.
E. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:
    1. Metalaire,
    2. Krueger,
    3. Nailor,
    4. Price,
    5. Titus,
    6. No Substitutions.

2.03 CEILING GRILLE

A. General: Except as otherwise indicated, provide manufacturer's standard grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
B. Performance: Provide grilles that have, as minimum, noise criteria ratings for each size device as listed in manufacturer's current data.
C. Ceiling Compatibility: Provide grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling construction that will contain each type of ceiling grille.
D. Types: Provide ceiling grilles of type and with accessories as listed on the air device schedule.

    1. Grille Finishes:

a. Finish shall be off-white baked enamel.

E. Manufacturer: Subject to compliance with requirements, provide grilles of one of the following:
1. Metalaire,
2. Krueger,
3. Nailor,
4. Price,
5. Titus,
6. No Substitutions.

2.04 LINEAR SLOT DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard diffusers where shown; of size, shape, capacity and type indicated; constructed materials and components as indicated, and as required for complete installation. Slot diffusers shall be constructed of aluminum with bi-directional, adjustable control vanes that shall be capable of deflecting the air pattern from horizontal along the ceiling, to straight down, or at an intermediate setting. Unit shall be so designed that when deflecting vanes are in the closed position, the air pressure tends to form a tight seal. Airflow rate can be varied without changing the air pattern. The set of vanes in the diffuser that controls the air pattern and flow rate shall perform these functions satisfactorily without the use of an additional damper. Each length of diffuser shall be capable of being installed without any visible means of fastening. Each length of diffuser shall have a self-aligning device permitting long lengths to be aligned without the aligning device visibly apparent.

B. Performance; Provide diffusers that have, as minimum, noise criteria ratings, pressure drop, and throw for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility; provide diffusers with borders styles that are compatible with adjacent ceiling systems or for suspended mounting, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling construction that will contain each type of slot diffuser.

D. Types: Provide slot diffusers of type and with accessories as listed on grille schedule.
1. Grille Finishes:
a. Finish shall be white baked enamel.
2. Boot Plenums:
a. Provide all slot diffusers with lined boot plenums with neck size equal to that shown in drawings on the run outs.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include; but are not limited to, the following:
1. Metalaire,
2. Krueger,
3. Nailor,
4. Price,
5. Titus,
6. No Substitutions.

2.05 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction Drawings and specifications for types of substrate that will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2 in. square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Provide Louver with Kynar finish, color selected by Architect.

G. Manufacturer: Subject to compliance with requirements, provide louvers of one of the following:
   1. Ruskin Co.
   2. Greenheck
   3. Nailor
   4. Louvers & Dampers, Inc.

2.06 OPPOSED BLADE DAMPER

A. Provide opposed blade dampers for all air devices unless where otherwise indicated on the plans.

B. Square damper frames shall be heavy duty extruded aluminum and interlocked to prevent corner separation. The blades shall be heavy gauge extruded aluminum, webbed to prevent bowing in large sizes and tapered to ensure tight closure. Blades shall be assembled on 1 in. centers and pivot on nylon bushings to ensure jam-free operation. Square neck opposed blade dampers shall be Metalaire Model D7 or approved equal.

C. Radial opposed blade dampers shall provide full radial volume control and manufactured of corrosion resistant aluminum material. Radial dampers shall provide durable, jam-free operation for the life of the air handling system. Radial dampers shall have overlapping blade design that insures positive shut-off when required. Radial damper operator shall be accessible through an opening located in the diffuser center cone. Radial opposed blade damper shall be Metalaire Model D3 or approved equal.

D. Radial slide dampers are not acceptable.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.03 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION 23 37 13

PART 1 GENERAL

1.01 GENERAL DESCRIPTION

A. This section includes the design, controls and installation requirements for 100% outside packaged rooftop units.

1.02 QUALITY ASSURANCE

A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

D. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

E. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.03 SUBMITTALS

A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with startup requirements shall be provided.

B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.05 WARRANTY

A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of Substantial Completion. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

B. The equipment vendor shall provide a preventative maintenance contract for a period of 12 months from the date of Substantial Completion. Refer to outline of coverage in Part 3 of this specification.

C. The equipment vendor shall provide a labor warranty for a period of 12 months from the date of Substantial Completion. Refer to outline of coverage in Part 3 of this specification.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Products shall be provided by the following manufacturers:
   1. AAON.
   2. No Substitutions.

2.02 PACKAGED OUTDOOR AIR HANDLING UNITS

A. General Description

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, electric heat, exhaust fans, energy recovery wheels, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction
1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, exhaust fans, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.
11. Unit base shall be fabricated of 1 inch thick double wall, impact resistant, rigid polyurethane foam panels.

C. Electrical
1. Unit shall have a 10k AIC SCCR rating as standard.
2. Unit shall be provided with a factory installed, powered, 120V convenience outlet.
3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

4. Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

D. Supply Fans
   1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
   2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
   3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
   4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Exhaust Fans
   1. Exhaust dampers shall be sized for 100% relief.
   2. Fans and motors shall be dynamically balanced.
   3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
   4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
   5. Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
   6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

F. Cooling Coils
   1. Evaporator Coils
      a. Coils shall be designed for use with R-454b refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
      b. Coils shall have interlaced circuitry and shall be 6 row high capacity.
      c. Coils shall be hydrogen or helium leak tested.
      d. Coils shall be furnished with factory installed expansion valves.

G. Refrigeration System
   1. Unit shall be factory charged with R-410A refrigerant.
   2. Compressors shall be scroll type with thermal overload protection and carry a 5-year non-prorated warranty, from the date of original equipment shipment from the factory.
   3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
   4. Compressors shall be isolated from the base pan with the compressor manufacturer’s recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
   5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
   6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.
   7. Unit shall include a variable capacity scroll compressor on all refrigeration circuits which shall be capable of modulation from 10-100% of its capacity.
   8. Unit shall include factory provided and installed compressor sound jackets on all compressors.
   9. Lead refrigeration circuits shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
   10. All refrigeration circuits shall be provided with factory installed hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.

H. Condensers

1. Air-Cooled Condenser
    a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
    b. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
    c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
    d. Coils shall be hydrogen or helium leak tested.
    e. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

I. Electric Heating
1. Provide unit with modulating SCR electric heat as scheduled.

J. Filters
1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
2. Unit shall include 1 inch aluminum mesh pre filters upstream of the outside air opening.
3. Unit shall include a clogged filter switch.
4. Unit shall include a Magnehelic gauge mounted in the controls compartment.

K. Outside Air/Economizer
1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return actuator. Unit shall include outside air opening bird screen, outside air hood, and barometric relief dampers.

L. Energy Recovery
1. Unit shall contain a factory mounted and tested energy recovery wheels. The energy recovery wheels shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
3. Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
4. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
5. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
6. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

7. Energy recovery wheel cassette shall carry a 5-year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5-year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
8. Unit shall include 2 inch thick, pleated panel outside air and exhaust air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
9. Hinged service access doors shall allow access to the wheels.
10. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

M. Controls
1. Provide and install a wall mounted control panel capable of scheduling, temperature & humidity adjustment and diagnostics. Control panel shall be Orion System Manager TS-L with LCD touch screen display.
2. The OAU shall be monitored (but not controlled) by the new building control system (BCS). The BCS shall be able to adjust space temperature setpoint only. Refer to BCS specifications and I/O points list.

N. Sequence of Operation
1. A Factory Installed Controller inside the unit is capable of stand-alone operation, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system. The onboard clock and calendar functions allow for occupancy scheduling. Controller has non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
2. Heating, Cooling and Dehumidification Controls:
   a. The unit will be equipped with an outside temperature sensor and outside humidity sensor. Also, install a temperature sensor and humidity sensor in the main return duct to detect average conditions coming from the building back to the unit.
   b. In cooling mode, fans are at constant speed, and the unit will modulate compressors to provide cooling based on outside temperature and return air temperature.
   c. In heating mode, fans are at constant speed, and the unit will modulate natural gas input to provide heat based on outside temperature and return air temperature.
   d. In dehumidification mode, fans are at constant speed, and the unit will modulate cooling and hot refrigerant gas reheat to meet outside air humidity loads and prevent supply air temperature swings and overcooling of the space.
   e. The unit is factory set to maintain 74°F in the building in both heating and cooling modes. This is adjustable via the control panel.
   f. The unit is factory set to provide dew point suppression by controlling cooling coil temperature and using hot refrigerant gas reheat in dehumidification if the outdoor dewpoint exceeds 55°F. If the humidity sensor in the return duct senses additional humidity, an override function in the unit will lower the cooling coil temperature to provide additional dehumidification. This is adjustable via the control panel.
3. The unit will operate at constant fan speed 24 hours per day, 7 days per week. It supplies 100% outside air to the building, and exhausts 100% of the air from the building to provide the minimum required air changes in each space.

O. Accessories

1. Unit shall be provided with two smoke detectors, one sensing the supply air and one sensing the return air. Detection of smoke shall be wired to shut off the unit's control circuit and signal the fire alarm system.
2. Ducted exhaust - refer to drawings.
3. Access platform for units set on grade - refer to drawings.

2.03 CURBS

A. A horizontal discharge curb shall be provided for units set on grade. Curb to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb to be 14 gauge galvanized steel with 2" thick insulation on walls and 1" insulation on the floor. Turning vanes shall be provided in the supply duct section. The curb shall be field painted same color as the unit.

PART 3 EXECUTION

3.01 INSTALLATION, OPERATION, AND MAINTENANCE

A. Installation, Operation, and Maintenance manual shall be supplied with the unit.
B. A manufacturer's representative shall be present to assist with the initial unit start-up and programming.
C. The condensate drain piping and p-trap shall be sized and installed in accordance with manufacturer's recommendations, based on unit static pressure.
D. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.
E. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.
F. Refer to Warranty section for preventative maintenance provided by manufacturer / vendor.

3.02 PREVENTATIVE MAINTENANCE CONTRACT (PROVIDED BY MANUFACTURER / VENDOR)

A. Included in the cost of the equipment is a one-year comprehensive maintenance program provided by the manufacturer / vendor of the packaged outside air unit.
B. The contract shall include site visits and inspections by the manufacturer's representative at least 7 times: once at start-up and once every two months during the first year of operation. Additional site visits may be required if filters need to be changed more frequently. The Manufacturer's representative shall instruct the Owner how to properly operate and maintain the unit during each visit.
C. The maintenance program shall include the following:
    1. Contact and check-in with the Customer.
    2. Record space temperature and humidity, and current setpoints.
    3. Record any abnormal conditions.
    4. Review logs with the customer for operational problems and trends
    5. Points of inspection / service shall include:
        a. Inspect for leaks and report leak check results.
        b. Repair minor leaks as required (e.g. valve packing, flare nuts).
        c. Check the sheaves and pulleys for wear and alignment.
        d. Check the belts for tension, wear, cracks, and/or glazing.
        e. Verify proper damper operation.
        f. Check mechanical linkages for wear, tightness, and clearances.
        g. Clean condenser and evaporator.
        h. Clean evaporator fan.
        i. Install clean air filters. Filters shall be changed every 60 days, or more frequently if required.
        j. Verify proper operation of the discharge air temperature control device.
        k. Verify proper operation of the outside air temperature control device.
        l. Verify proper operation of the discharge humidity control device.
        m. Test the operation of the high condenser pressure safety device.
        n. Test the operation of the low temperature safety device.
        o. Test the operation of the low pressure safety device(s).
        p. Lubricate motor bearings, if applicable.

q. Lubricate fan bearings.
r. Check oil level in the compressor(s), if applicable.
s. Clean the starter and cabinet.
t. Inspect wiring and connections for tightness and signs of overheating or discoloration.
u. Check the contactors for free and smooth operation.
v. Meg the compressor motor(s) and record readings.
w. Verify the tightness of the compressor motor terminal connections.
x. Restart the unit after all inspections are complete.
y. Verify the starter and controller operation.
z. Verify the smooth operation of the compressors and fans.
aa. Log operating conditions of the unit after the system has stabilized.
bb. Review operating procedures with the Customer.
cc. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies.

3.03 ONE-YEAR LABOR WARRANTY (PROVIDED BY MANUFACTURER / VENDOR)

A. Included in the cost of the equipment is a one-year labor warranty provided by the manufacturer / vendor of the packaged outside air unit. The Mechanical Contractor shall omit the cost of the first year labor warranty from their contract.

B. The labor warranty shall cover all labor required to replace defective parts during the first year of operation. This warranty will supplement the one-year parts warranty provided by the equipment manufacturer.

END OF SECTION 23 75 33

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PART 1 GENERAL

1.01 GENERAL

A. All work shall be in accordance with the "General Conditions", "Supplemental Conditions" and the "General Requirements for Mechanical Work".

B. All work shall be in accordance with City Building, Plumbing and Mechanical Codes and with all state and national codes as they may apply to the project and to public safety.

1.02 SCOPE OF WORK

A. It is the intent that the contractor shall install a complete and operable air conditioning system, fully adjusted and ready for use.

B. Materials and equipment have been carefully selected for the project. The Contractor is expected to furnish and install items that the specification required as closely as possible.

C. The drawings accompanying these specifications show the extent of the HVAC work and the general arrangement. The drawings, however, are diagrammatic and exact layout of the systems is the responsibility of the Contractor.

1.03 HVAC SUBMITTAL

A. The Contractor shall check all items of submittal data and verify by statement and initial that each item has been checked for the following conditions:
   1. Item is equal to specified item in construction and quality.
   2. Item is of the same physical size. If not of the same physical size, the dimensions have been checked and item will fit within the allocated space shown on the drawings. Where items proposed are different than scheduled item, furnish 1/4 in. scale plan and 1/4 in. sections on tracing paper (for direct overlay) of proposed equipment including space required for connections or service. The tracing of 1/4 in. plans and 1/4 in. sections must be furnished in submittal for other than scheduled equipment in order to compare proposed equipment with scheduled equipment.
   3. System connections to the item can be made as shown on the drawings.
   4. Shop drawings show in detail all connections, etc., required to meet the overall specifications in every detail.
   5. Statement of guarantee that the proposed equipment shall operate properly as applied to the project and will not require additional devices or changes in the installation shown on the drawings.

B. Complete specification data shall be submitted for all HVAC items, including the list below:
   1. Ductless Split Air Conditioning Units

C. When equipment other than specified is proposed, the Contractor shall be responsible for the proper design and installation of electrical power to equipment. Submit listing of electrical feeder size, conduit size, breaker size, etc., for each item of equipment for review.

PART 2 MATERIALS

2.01 DUCTLESS SPLIT AIR CONDITIONING UNITS

A. General - Furnish and install an indoor ductless fan coil unit and outdoor heat pump unit. The unit shall be shipped completely factory assembled, piped and wired internally ready for field connections. In addition, manufacturer shall test operate unit at the factory before shipment. The equipment shall be standard products of a firm regularly engaged in the manufacturer of heating-cooling equipment. The manufacturer shall have parts and service available throughout the United States.

B. Unit Capacity - The total cooling capacity and total heating capacity shall be as scheduled.

C. Compressor - Units shall be single speed compressors or two speed compressors providing staging control to deliver varying cooling load requirements. Compressor shall be resiliently mounted, suction cooled, overload protected, internal pressure relief protected and have internal excessive current and temperature protection. Units shall have vertical crankshaft, ringed valves and piston, tuned discharge muffler, efficient oil pump and crankcase heater.

D. Refrigerant System - Shall include liquid line service valve, suction line service valve, gauge ports, hi-capacity drier, thermometer well, high and low pressure switches and timed-off control.

E. Condenser Coil(s) - Coil(s) shall be non-ferrous construction with aluminum fins mechanically bonded to durable copper tubes. Coil(s) shall be pressure leak tested. Coil(s) shall be protected with expanded metal type hail guard(s).
F. Air Mover - Shall be direct blade type fan(s). Motor(s) shall have inherent protection devices and shall be protected from moisture. Fan(s) shall be protected with steel guard(s).
G. All wiring shall be in compliance with NEC. All wiring shall be rated in accordance with ARI Standard 210-81 and 360-86. Units shall have UL listing. Units shall have ETL Testing Laboratories listing where applicable.
H. Indoor unit cabinet shall be of a durable ABS plastic with a galvanized steel sub-chassis. The filter shall be nylon mesh, easily accessible, washable and reusable. Unit shall have manually adjustable discharge fins. Unit shall be wall mounted with all pipe connections accessible from the cabinet. There shall be a removable end-cap for access to controls and for servicing.
I. Condensate drain pan shall be made of galvanized steel and shall come with an anti-corrosion coating.
J. A condensate pump shall be provided and installed for the indoor unit.
K. Warranty - The compressor shall have a warranty for five years. All other components shall have a warranty for one year.
L. Acceptable manufacturers:
    1. Mitsubishi
    2. Samsung
    3. Daikin
    4. LG

2.02 REFRIGERANT PIPING

A. Pipe material shall be Type "L" copper tubing, hard drawn with copper solder type fittings suitable for connection with silver solder. Soft drawn copper "pre-charged" refrigerant piping should be acceptable for split-system units where developed length between evaporator and condensing unit is within manufacturer guidelines.
B. All piping shall be installed parallel or perpendicular to the building construction. All piping shall be installed so as to allow for expansion.
C. When "pre-charged" piping is not used, all piping joints shall be made with silver solder. The piping shall be charged with dry nitrogen while constructing the joints. A removable type drier strainer shall be installed in the liquid line. After the Freon piping has been completed, the refrigerant system shall be pressured tested at a pressure of 300 psi (high side) and 150 psi (low side. While the system is being pressure tested, an electronic leak detector shall be used to check for leaks. Pressure shall be maintained on the system for a minimum of 12 hours. The system shall be evacuated when the surrounding ambient air is not less than 60°F. A minimum vacuum of 2.0mm of mercury shall be pulled on the system and maintained for 12 hours. The vacuum pressure displacement shall be not less than 5 CFM. The vacuum shall be checked with an electronic gauge.
D. All pipes shall be supported from the building structure in a neat and workmanlike manner, and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted. Spacing of pipe supports shall not exceed 8 ft. for pipes up to 1-1/4 in. and 10 feet on all other piping. Hangers shall pass around the insulation and an 18 guage steel protective band, 12 in. long, shall be inserted between the hangers and the insulation.
E. Insulation material shall be 1 in. thick for all pipe sizes up to and including 1-1/2 in., 1-1/2 in. thick for all pipe sizes over 1-1/2 in., foamed plastic, heavy density, J-M Aero tube, or approved equal. All refrigerant suction piping shall be insulated. Pipe insulation shall have a flame spread rating of not over 25, 50 smoke developed and 50 fuel contributed. Verify insulation requirements with code when installed in return air plenum spaces.
F. All pipe insulation shall be applied over clean, dry surfaces, butting adjoining sections firmly together. All fittings shall be installed and finished in strict accordance with manufacturer's recommendations. Insulation exposed to weather shall have waterproof and UV resistant covering.

2.03 CONTROLS

A. Provide a wall mounted, wired thermostat for each indoor unit. Space temperature shall be monitored by the BCS.

PART 3 INSTALLATION

3.01 EXAMINATION

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. General: Install units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Electrical Connections: Coordinate with Electrical for final connections to equipment and installation of loose-shipped electrical components.

3.03 DEMONSTRATION

A. Start-Up Services: Provide the services of a factory-authorized service representative to start-up units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Operating and Maintenance Training:

1. Provide services of manufacturer's service representative to instruct Owner's personnel in operation and maintenance of units. Training shall consist of a minimum of 8 hours, not necessarily consecutive, and shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division 01.

END OF SECTION 23 81 27

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PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. The variable capacity, heat pump with heat recovery air conditioning system shall be a complete system of one manufacturer.

B. The system shall consist of simultaneous heating and cooling outdoor units, BC (Branch Circuit) Controllers indoor fan coil units, and DDC (Direct Digital Controls) for control of the VRF system and other systems equipment per the project plans and specifications. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 2 degrees F from set point for ten minutes.

C. If an alternate manufacturer is selected, any additional material, cost, and labor to install additional refrigerant lines, branch controllers, fittings, or other required components shall be incurred by the installing contractor. The installing contractor shall be responsible for additional costs incurred by other contractors and subcontractors as a result of installing an alternate manufacturer's system. The installing contractor must provide complete drawings and documentation identifying all differences between the alternate manufacturer and the basis of design system, subject to engineer’s approval. All costs associated with reviewing and approving these drawings and documentation shall be incurred by the installing contractor.

1.02 QUALITY ASSURANCE

A. The units shall be listed by Nationally Recognized Testing Laboratory and bear their label (UL or ETL).

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and these specifications.

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001 which are a set of standards applying to quality managment and environmental protection, set by the International Organization for Standardization (ISO).

D. All units must meet or exceed the current version of ASHRAE 90.1 energy efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit. Contractor will provide additional refrigerant based on manufacturer's design guidelines and approval of system design by manufacturer’s representative.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendation.

1.04 WARRANTY

A. Contractor to provide minimum five (5) year warranty on refrigerant piping installation.

B. All equipment shall be covered by an extended manufacturer’s limited parts warranty for a period of ten (10) years from date of installation. In addition, the compressor shall have a manufacturer’s limited parts warranty for a period of ten (10) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired.

C. Manufacturer’s rep. shall provide one (1) year labor and preventative maintenance warranty for the entire VRF system.

1.05 CONTRACTOR QUALIFICATIONS AND MANUFACTURER REQUIREMENTS

A. The VRF system shall be installed by a contractor with a minimum of (five) 5 years of VRF installation and service experience. The mandatory contractor service and install training must be performed by the manufacturer prior to equipment submittal. Training must be a minimum of two (2) days at a manufacturer approved training facility with equipment present. The contractor shall submit a copy of successful training certification in compliance with these requirements. All travel and training expenses are the responsibility of the contractor.

B. All employees of the contractor that will be on site installing the VRF system must have completed the manufacturer's training course and be certified by the manufacturer to install the system.
C. Manufacturer must provide controls integration training to the temperature controls subcontractor. Training must be a minimum of 1 day at a manufacturer's approved training facility with equipment present. All travel and training expenses are the responsibility of the installing contractor.
D. The representative must visit the construction site to verify each VRF system is being installed per the manufacturer's requirements. Observations of the installations must occur before refrigerant piping systems (including valves, sensors and inline devices) are covered by walls or ceilings. This is required for all systems being installed and must be coordinated by this contractor. The manufacturer's representative must submit a report to the Engineer of record and the general contractor of their observations and any corrective items that may need to occur.
E. Manufacturer must provide a minimum of 4 site visits by a representative during construction to verify installation compliance as set forth by the manufacturer and their installation instructions
F. Manufacturer must provide startup assistance and controls integration assistance for each installed system and provide a start up report to the Engineer.
G. Manufacturer must provide a minimum of 4 hours of Owner training on VRF System.
H. Manufacturer must provide a minimum of 4 hours of Owner training on VRF Control System.

1.06 REFRIGERANT PIPING SYSTEM

A. Refer to Section 23 23 00 for piping materials and other requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements; provide VRF units of one of the following.
   1. LG
   2. Daikin
   3. Mitsubishi
   4. No Substitutions

2.02 AIR-SOURCE OUTDOOR UNITS

A. General:
   1. The outdoor units shall be used specifically with VRF components. The outdoor units shall be equipped with required controls and safeties and directly interface to the VRF controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
   2. All units requiring factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s).
   3. Outdoor unit shall have a sound rating no higher than 58 dB(A) individually or 61 dB(A) twinned.
   4. All refrigerant piping from the outdoor unit to the branch controllers shall be insulated.
   5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
   6. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
   7. The outdoor unit shall have rated performance of heating operation at -13°F ambient temperatures and cooling mode down to 23°F ambient temperatures, without additional low ambient controls. The unit shall maintain 100% heat output at 0°F and 85% heat output at -13°F without a supplemental heat source or a second compressor to boost low ambient heating performance. Systems shall be capable of providing indoor unit high fan speed supply air temperatures as indicated on the equipment schedules.
   8. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
   9. The outdoor unit shall be provided with a manufacturer-supplied 20 gauge hot dipped galvanized snow /hail guard for all condenser open sides.
B. Heat Interchanger Circuit:
   1. The outdoor unit shall contain a heat interchanger circuit for sub-cooling liquid prior to entering the outdoor coil during the heating mode.

2. The interchanger shall be of a copper tube within a tube construction.
3. The interchanger circuit refrigerant flow shall be controlled by an electronic expansion valve.

C. Unit Cabinet:
1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

D. Fan:
1. Each outdoor unit module shall be furnished with one (1) direct drive, variable speed propeller-type fan. The fan shall be factory set for operation under 0 in. W.G. external static pressure, but capable of normal operation under a maximum of 0.24 in. W.G. external static pressure via dipswitch.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

E. Refrigerant
1. R-410A refrigerant shall be required.
2. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit safety data sheets (SDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two (2) weeks prior to bidding.

F. Coil:
1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. The outdoor coil shall include four (4) circuits with two position valves for each circuit, except for the last stage.

G. Compressor:
1. Each outdoor unit module shall be equipped with inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
2. A crankcase heater(s) shall be factory mounted on the compressor(s).
3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 6% of rated capacity.
4. The compressor will be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.
6. Field installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

H. Controls:
1. The outdoor unit shall have the capability of up to four (4) levels of demand control for each refrigerant system.

I. Electrical:
1. The outdoor unit electrical power shall be 208-volts, three-phase, 60 Hz.
2. The outdoor unit shall be controlled by intelligent microprocessors.
3. The control circuit between the indoor units, BC Controllers and the outdoor unit shall be 24 VDC completed using a two-conductor, twisted-pair shielded cable to provide total integration of the system.

2.03 BRANCH CONTROLLERS (BRANCH DEVICES)

A. General:
1. The branch controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or sub-cooled liquid refrigerant to flow to indoor unit(s) for cooling.

2. The units shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The branch controllers shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. The units shall be mounted indoors, with access and service clearance provided for each controller.
3. Each branch device, regardless of manufacturer, must be installed in the designated areas as indicated on the project drawings. Installation of branch devices outside of these areas and in the occupied floor space or corridors is not allowed.
4. Each port on the branch devices shall be provided with manufacturer's ball valve.

B. Unit Cabinet:
1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator, multiple refrigeration control valves, and tube-in-tube heat exchanger(s).

C. Refrigerant valves:
1. The unit shall be furnished with multiple two position refrigerant valves.
2. When connecting a 54,000 BTU/h or larger indoor unit section, two (2) branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two (2) refrigerant valves shall operate simultaneously.
3. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

D. Integral Drain Pan:
1. An integral condensate pan and drain connection shall be provided.

E. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187- 228 volts (208V/60Hz) or 207-253V (230V/60Hz).
3. The unit shall be controlled by integral microprocessors.

2.04 CEILING CASSETTE – 4 WAY

A. General:
1. Unit shall be designed to be installed for indoor application.
2. Unit shall be designed to mount recessed in the ceiling and has a surface mounted grille on the bottom of the unit.
3. The unit shall be available in both nominal 2' x 2' and 3' x 3' chassis.

B. Casing/Panel
1. Unit case shall be manufactured using galvanized steel plate.
2. The unit panel shall be provided with an off-white or black Acrylonitrile Butadiene Styrene (ABS) polymeric resin grille.
3. The grille shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
4. Unit shall be provided with metal ears designed to support the unit weight on four corners.
5. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
6. Unit shall be supplied with snap off access panels to facilitate leveling of unit without removing the grille.

C. Cabinet Assembly
1. Unit shall have four supply air outlets and one return air inlet.
2. The supply air outlet shall be through four directional slot diffusers each equipped with independent oscillating motorized guide vanes designed to change the airflow direction.
3. The grille shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes.
4. The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in counterclockwise pattern.
5. Guide vanes shall provide airflow in all directions.
6. Unit shall be equipped with factory installed temperature thermistors for:
   a. Return air
   b. Refrigerant entering coil
   c. Refrigerant leaving coil

7. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
8. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
9. The unit shall have factory designated branch duct knockouts on the unit case.
10. The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
11. The branch duct knockouts shall have the ability to duct up to 1/2 the unit airflow capacity.
12. The branch duct cannot be ducted to another room.
13. Unit shall have the following functions as standard:
    a. Self-diagnostic function
    b. Auto addressing
    c. Auto restart function
    d. Auto changeover function (Heat Recovery system only)
    e. Auto operation function
    f. Child lock function
    g. Forced operation
    h. Dual thermistor control
    i. Sleep mode
    j. Dual set point control
    k. Multiple aux heater applications
    l. Filter life timer
    m. External on/off input
    n. Wi-Fi compatible
    o. Auto fan operation
    p. Leak detection logic

D. Fan Assembly
1. The unit shall have a single, direct-drive turbo fan made of high strength ABS HT-700 polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
4. The fan motor shall include thermal, overcurrent and low RPM protection.
5. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
6. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of four pre-programed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
7. A field setting shall be provided to vary air throw pattern to compensate for high ceiling installations.
8. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Super high, Power Cool, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, Super high and Auto.
10. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.

E. Filter Assembly
1. The return air inlet shall have a factory supplied removable, washable filter.
2. The unit shall have the capability to accept a field provided MERV 1 to MERV 10 filter.
3. The filter access shall be from the bottom of the unit without the need for tools.
4. The nominal 3’x3’ cabinet unit shall have provision for an optional auto-elevating grille kit designed to provide motorized ascent/descent of the return air grille/pre filter assembly.
    a. The ascent/descent of the return air grille shall be up to a distance of 14-3/4 feet allowing access to remove and clean the filter.
    b. The auto-elevating grille shall have a control algorithm to accept up, down and stop control commands from the controller.

c. The auto-elevating grille shall have a control to stop the descent automatically if a contact is made with any obstacle.

F. Coil Assembly
1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum one or two row coil, 18-19 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
5. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit.
6. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 550 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

G. Microprocessor Control
1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted and shielded communication cable.
3. The unit controls shall operate the indoor unit using one of the five operating modes:
   a. Auto changeover (Heat Recovery System only)
   b. Heating
   c. Cooling
   d. Dry
   e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
7. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
8. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.

2.05 DUCTED – HIGH STATIC

A. General:
1. Unit shall be designed to be installed for indoor application.
2. Unit shall be designed to mount fully concealed above the finished ceiling.
3. Unit shall have opening to supply air from front horizontal and a dedicated rear horizontal return.
4. The supply and return air shall be flanged for field installed ductwork that shall not exceed the external static pressure limitation of the unit.

B. Casing/Panel
1. Unit case shall be manufactured using galvanized steel plate.
2. The cold surfaces of the unit shall be covered internally with a coated polystyrene insulating material.
3. The cold surfaces of the unit shall be covered externally with sheet insulation made of Ethylene Propylene Diene Monomer (M-Class) (EPDM).
4. The external insulation shall be plenum rated and conform to ASTM Standard D-1418.

5. Unit shall be provided with hanger brackets designed to support the unit weight on four corners.
6. Hanger brackets shall have pre-punched holes designed to accept field supplied, all thread rod hangers.

C. Cabinet Assembly
1. Unit shall have horizontal supply air discharge outlets and a return air inlet.
2. Unit shall be equipped with factory installed temperature thermistors for:
   a. Return air
   b. Refrigerant entering coil
   c. Refrigerant leaving coil
3. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
4. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
5. Unit shall have the following functions as standard:
   a. Self-diagnostic function
   b. Auto addressing
   c. Auto restart function
   d. Auto changeover function (Heat Recovery system only)
   e. Auto operation function
   f. Child lock function
   g. Forced operation
   h. Dual thermistor control
   i. Sleep mode
   j. External static pressure (ESP) control
   k. Dual set point control
   l. Multiple aux heater applications
   m. Filter life timer
   n. External on/off input
   o. Wi-Fi compatible
   p. Auto fan operation
   q. Leak detection logic

D. Fan Assembly
1. The unit shall have direct drive fans.
2. The fan impeller shall be statically and dynamically balanced.
3. The fans shall be mounted on a common shaft.
4. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
5. The fan motor shall include thermal, overcurrent and low RPM protection.
6. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
7. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of three pre-programed fan speeds, each setting is also adjustable by field setting to compensate for a limited amount of additional resistance to airflow by adjusting the RPM of the fan motor.
8. In cooling mode, the indoor fan shall have the following settings; Low, Med, High, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
10. Each of the settings can be field adjusted from the factory setting (RPM/ESP).
11. Unit shall be designed for high speed air volume against an external static pressure of up to 0.98” water gauge, model dependent.

E. Filter Assembly
1. The return air inlet shall have a factory supplied removable, washable filter. MERV 13 filter rack is available as an option, model dependent.
2. The filter access shall be from the rear of the unit.

F. Coil Assembly
1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.

2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum two to three row coil, 19-21 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
5. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit. The unit drain pan is supplied with a secondary drain port/plug allowing the pan to be gravity drained and serviced.
6. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan, model dependent.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 550 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

G. Microprocessor Control
1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable.
3. The unit controls shall operate the indoor unit using one of the five operating modes:
   a. Auto changeover (Heat Recovery System only)
   b. Heating
   c. Cooling
   d. Dry
   e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall be able to operate with a continuous fan setting.
7. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
8. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.

2.06 ELECTRONIC EXPANSION VALVE (EEV) KIT

A. General:
1. Unit shall be factory assembled and wired unit shall be designed to be installed indoors only.
2. Unit shall be capable to be installed with heat pump or heat recovery VRF system.
3. Unit requires one communication kit to provide power and control signals.
4. Unit shall connect liquid line piping from outdoor unit to AHU coil.

B. Casing/Cover
1. Carbon steel casing with removable cover secured by (4) screws
2. The external surface shall be finished with a high gloss baked enamel finish, morning fog color
3. Internal zinc plated mounting plate supporting insulated EEV assembly and terminal block with ABS enclosure
4. Open bottom panel for refrigerant pipe and control wiring
5. Four predrilled mounting holes at rear panel for attachment to AHU

C. Electrical

1. Six conductor, 18 GA shielded and stranded field supplied wiring for 12 volt (low voltage) power and control signal from communication kit

D. Limited Warranty
   1. Please refer to the respective outdoor unit for applicable warranty.

E. AHU Communication Kit (Return Air Control)
   1. General:
      a. Unit shall be factory assembled and wired.
      b. Unit shall be designed to be installed for indoor or outdoor.
      c. Unit shall be capable to be installed with heat pump or heat recovery VRF system.
      d. Allows communication between third party air handling unit (AHU) and LG Multi V air-source or water-source outdoor units with combination ratio between 50% to 100%.
      e. Requires one EEV kit to control the flow of refrigerant from Multi V outdoor unit to AHU coil.
   2. Casing/Door
      a. Carbon steel housing and door
      b. Unit case shall have a light grey finish, powder coated
      c. NEMA 4 enclosure
      d. Hinged front door with (1) key operated lock
      e. Foamed in polyurethane door seal
      f. Internal zinc plated mounting plate supporting spring push pin type terminal microprocessor control board
      g. Four wiring knockouts located at bottom of panel
      h. Four predrilled mounting holes at rear panel for attachment to AHU
   3. Microprocessor Control:
      a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
      b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, 2 core, stranded and shielded communication cable.
      c. The unit controls shall operate the AHU using one of the following operating modes:
         1) Heating
         2) Cooling
         3) Fan only
      d. AHU coil entering air operating temperature limits
         1) Cooling mode: 64°F to 104°F DB
         2) Heating mode: 41°F to 86°F DB
      e. Protection logic to turn off ODU at the following AHU coil entering air temperatures:
         1) Cooling mode: less than 64°F DB
         2) Heating mode: greater than 86°F DB (41°F is minimum for heating)
      f. Fan speed control signal for the following AHU fan motors (Note: VFD Fan control is not supported by comm. kit and will required separate 3rd party AHU controller)
         1) Single speed
         2) Three speed (high/medium/low)
      g. EEV control:
         1) Adjusts EEV position based on superheat temperatures as monitored from the evaporator coil pipe in/out thermistors
         2) Six conductor 18 GA shielded and stranded field supplied wiring for 12 volt (low voltage) power and control and signal to EEV kit
   4. Electrical:
      a. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz)
      b. The unit shall be capable of operating within voltage limits of +/- 10%
   5. Thermistors:
      a. One return air temperature thermistor, shipped loose for field mounting at mixed return air side of AHU coil
      b. One evaporator coil pipe inlet temperature thermistor, shipped loose for field mounting between EEV kit and evaporator coil

c. One evaporator coil pipe outlet temperature thermistor, shipped loose for field mounting

6. Capacity options
   a. Capacity options to match AHU coil load shall be selectable by adjusting dip switch settings
7. Controls
   a. Programmable thermostats
   b. Central Controllers: ODU can be viewed and controlled by a central controllers connected to outdoor units

F. Communication Kit (Supply Air Control)
1. Unit shall be factory assembled and wired.
2. Unit shall be designed to be installed for indoor or outdoor.
3. Unit shall be capable to be installed only with heat pump VRF systems.
4. Allows communication between third party air handling unit and LG MultiV air-source or water-source outdoor units with combination ratio between 50% to 100%.
5. Requires one EEV kit to control the flow of refrigerant from outdoor unit to AHU coil.
6. Requires 3rd party AHU controller that can control AHU fan and send/accept the following signals:
   a. Output signals
      1) Analog: (0-10 volt) to control ODU capacity between 0 and 100%
      2) Digital: Thermal On/Off (open/close the EEV)
      3) Digital: Mode Change
   b. Input signals
   c. Running status
   d. Compressor status
   e. Running mode
   f. Error status
7. Casing/Door
   a. Carbon steel housing and door
   b. Unit case shall have a light grey finish, powder coated
   c. NEMA 4 enclosure
   d. Hinged front door with (1) key operated lock
   e. Foamed in polyurethane door seal
   f. Internal zinc plated mounting plate supporting spring push pin type terminal microprocessor control board
   g. Four wiring knockouts located at bottom of panel
   h. Four predrilled mounting holes at rear panel for attachment to AHU
8. Communication Module:
   a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
   b. The unit shall be able to communicate with the outdoor unit using a field supplied minimum of 18 AWG, 4 core, stranded and shielded communication cable.
   c. The unit controls shall operate the AHU using one of the following operating modes:
      1) Heating
      2) Cooling
      3) Fan only
   d. AHU coil entering air operating temperature limits
      1) Cooling mode: 64°F to 104°F
      2) Heating mode: 41°F to 86°F
   e. Protection logic to turn off ODU at the following AHU coil entering air temperatures (can be bypassed by replacing return air thermistor with 10K Type 2 resistor, when discharge air control is being used)
      1) Cooling mode: less than 64°F
      2) Heating mode: greater than 86°F
   f. EEV control:
      1) Adjusts EEV position based on superheat temperatures as monitored from the evaporator coil pipe in/out thermistors

2) Six conductor field supplied wiring for 12 volt power and control signal to EEV kits <PRLK048A0, PRLK096A0>

9. Main Module
   a. Can accept/send the following signals from a 3rd party AHU controller
      1) Input signals
         (a) Analog: (0-10 volt) to control ODU capacity between 0 and 100%
         (b) Digital: Thermal On/Off (open/close the EEV)
         (c) Digital: Mode Change
      2) Output signals
         (a) Running status
         (b) Compressor status
         (c) Running mode
         (d) Error status
10. Electrical:
   a. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz)
   b. The unit shall be capable of operating within voltage limits of +/- 10%
11. Thermistors:
   a. One return air temperature thermistor, shipped loose for field mounting at mixed return air side of AHU coil (when using discharge air control this return air thermistor should be replaced with 10K Type 2 resistor to prevent protection logic shut down)
   b. One evaporator coil pipe inlet temperature thermistor, shipped loose for field mounting between EEV kit and evaporator coil
   c. One evaporator coil pipe outlet temperature thermistor, shipped loose for field mounting
12. EEV Capacity control printed circuit board (PCB)
   a. Capacity options to match AHU coil load shall be selectable by adjusting dip switch settings.
13. Required Additional Controls (for error code display)
   a. Programmable thermostats
14. Additional Controls
   a. Central Controllers: ODU can be viewed and controlled by a central controller connected to outdoor units.

2.07 CONTROLS

A. General:
   1. The controls network shall be capable of supporting remote controllers, centralized controllers, non-VRF equipment as detailed in the building automation system specification and sequence of operations, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet.
   2. The VRF manufacturer shall offer and provide a mobile controller or equivalent tablet app. The App shall allow for monitoring and controlling of the VRF system via a Wi-Fi connection and a Local Area Network. Each indoor unit shall be monitored and controlled in terms of on/off, mode, set temperature, space temperature (monitor only), fan speed, vane direction. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
   3. System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.
   4. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
   5. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.
   6. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

7. System shall be capable of email generation for remote alarm annunciation.
8. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in VRF controls system configuration and operation. The representative shall provide proof of certification indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

B. Electrical Characteristics
1. The controls network shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.
2. Wiring:
   a. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
   b. Control wiring for the remote controllers shall be from the remote controller (receiver) to the first associated indoor unit then to the remaining associated indoor units in a daisy chain configuration.
   c. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
   d. The centralized controller shall be capable of being networked with other centralized controllers.
3. Wiring type:
   a. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
   b. Network wiring shall be CAT-5 with RJ-45 connection.
4. The Controls Network consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks* or BACnet interfaces.
5. Remote Controllers
   a. The backlit remote controller shall be capable of controlling up to 16 indoor units (defined as 1 group). Certain indoor units, as required by the owner, shall utilize 2 remote controllers per indoor unit. The remote controller shall be compact in size, approximately 3” x 5", and have limited user functionality. The controller supports temperature display selection of Fahrenheit or Celsius. The controller shall allow the user to change on/off, mode (cool, heat, auto, dry, and fan), temperature setting, and fan speed setting and airflow direction. The controller shall be able to limit the set temperature range. The controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the controller or the indoor unit dependent on the indoor unit dipswitch setting. The controller shall display a four-digit error code in the event of system abnormality/error. There shall be up to two remote controllers per group. The controller shall require no addressing. The controller shall connect using two-wire, stranded, non-polar control wire to the connection terminal on the indoor unit. The controller shall require cross-over wiring for grouping across indoor units.

C. Building Management System Integration:

1. The interface shall be compliant with BACnet Protocol (ANSI/ASHRAE 135-2004) and be certified by the (BTL) BACnet Testing Laboratories. The BACnet interface shall support BACnet Broadcast Management (BBMD). The BACnet interface shall support a maximum of 150 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

2.08 ELECTRICAL

A. The unit electrical power shall be as scheduled.
B. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage

2.09 CONTROLS

A. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

PART 3 EXECUTION

3.01 INSTALLATION

A. Connect services to the unit where called for, in complete accordance with the Manufacturer's Installation Instructions. Furnish Division 26 with wiring diagrams and electrical data to permit power wiring connections to the unit. Provide control wiring serving air handling unit associated condensing unit, and the auxiliary control panel in accordance with Section "Electric Wiring." Charge system with Refrigerant after leak testing, and in accordance with Manufacturer's Installation Instructions.
B. Manufacturer shall provide start-up assistance and owner training.
C. Provide two (2) sets of washable filters for each indoor air handler.
D. All refrigerant lines from the outdoor unit to the indoor unit shall be individually insulated.
E. For floor mounted console units, provide perforated sheetmetal shroud between pipe portal legs, to fully cover space between legs. Shroud shall be minimum 16 gauge, with equally spaced 3/16-in. diameter perforations at 1/4-in. staggered centers, 18 holes per square inch, with 50% free area. Shroud shall be painted with two coats of flat black paint to match finish of pipe portal legs. Secure shroud to legs with sheetmetal screws.
F. Install ball valves on each incoming and outgoing refrigerant pipe at each branch selector box and outdoor heat pump.

END OF SECTION 23 81 50

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PART 1 GENERAL

1.01 SUMMARY

A. Manufacturer's Data: Submit manufacturer's data and installation instructions on motor controllers.

1.02 QUALITY ASSURANCE

A. Comply with applicable requirements of NEC as applicable to installation, and construction of motor controllers.

B. Comply with applicable requirements of NFPA 70E, "Electrical Safety Requirements for Employee Workplaces," latest edition.

C. Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components that are UL-listed and labeled.

D. Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies", and Pub. No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)", pertaining to motor controllers and enclosures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide motor controllers of one of the following (for each type and rating of motor controller):

1. Allen-Bradley Co.
2. Cerus Industrial.
3. General Electric Co.
4. Square D Co.
5. Danfoss-Graham.
6. Cutler-Hammer

2.02 MOTOR CONTROLLERS

A. Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published information, and as required for a complete installation.

B. Fractional HP Manual Controllers: Provide single-phase fractional HP manual motor controllers, of sizes and ratings required to operate the motors shown on the contract documents. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Controller to become inoperative when thermal unit is removed. Provide controllers with double break silver alloy contacts, visible from both sides of controller; green pilot lights, and switch capable of being padlocked OFF. Enclose controller unit in NEMA Type 1 general-purpose enclosure suitable for flush mounting; coat with manufacturer's standard color finish for indoor installation. Enclose controller unit in weatherproof general-purpose enclosure coated with manufacturer's standard color finish for outdoor installation and where device is exposed to moisture.

C. Magnetic Starter, Across-The-Line:

1. Motor starters shall be across-the-line magnetic type rated in accordance with NEMA Standards, sizes and horsepower ratings as required for the motor controlled. Starters shall be mounted in general-purpose enclosures unless otherwise indicated on plans.
2. Across-the-line magnetic starters through NEMA size seven shall be equipped with double break silver alloy contacts. Single break contacts shall be supplied on size eight starters. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
3. Coils shall be of molded construction through NEMA size seven. Coils on size eight starters shall be form wound, taped, varnished and baked. All coils shall be replaceable from the front without removing the starter from the panel.

4. Overload relays shall be the melting alloy type with a replaceable control circuit module. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed. Provide overload heaters to protect the motor to be controlled.
5. Provide one spare normally-open contact and one spare normally-closed contact in each NEMA size 0 through size 7 starters.
6. Magnetic starters with "Hand-Off-Auto" selector switch and Form C contact, as manufactured by Square D, or acceptable substitute, three-pole, three-phase of NEMA size applicable with three melting alloy overload relays and three-position H-O-A switch in cover of general purpose enclosure.
7. Provide starters of the proper NEMA size to control each motor. Do not provide starters smaller than NEMA size 0.
8. Provide starters with low voltage transformers.

PART 3 EXECUTION

3.01 COORDINATION WITH DIVISION 26

A. Portions of the work will be provided under Division 26. Refer to Section 23 05 12 for coordination of the work with Division 26.

3.02 EXAMINATION

A. Examine areas and conditions under which motor controllers are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.03 INSTALLATION OF MOTOR CONTROLLERS

A. Install motor controllers for each motor, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.
B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

3.04 FIELD QUALITY CONTROL

A. Prior to energization of motor controller equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to insure requirements are fulfilled.
B. Prior to energization, check circuitry for electrical continuity, and for short-circuits.
C. Ensure that direction of rotation of each motor fulfills requirements.
D. Ensure that motor overloads are properly sized and installed.

3.05 GROUNDING

A. Provide equipment-grounding connections for motor controller equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.06 ADJUSTING AND CLEANING

A. Adjust operating mechanisms, where necessary, for free mechanical movement.

3.07 DEMONSTRATION

A. Upon completion of installation of motor controller equipment and electrical circuitry, energize controller circuitry and demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION 23 89 65

PART 1 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division and as shown on the Contract Drawings.

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

1.02 DRAWINGS AND SPECIFICATIONS

A. Prior to submitting a bid:
   1. Examine the Drawings.
   2. Read the Specifications and other Contract Documents, including Addenda and referenced material.
   3. Visit the site of the work.
   4. Become informed prior to bidding as to existing conditions and limitations of the project.

B. Bring exceptions and inconsistencies in Drawings, specifications, addenda, referenced material, other Contract Documents and site conditions to the attention of the Architect in writing seven days before the bid opening; otherwise be responsible for changes and additions that become necessary during construction.

C. Interpretation or correction of the Contract Documents will be made by Addendum and will be mailed or delivered to each Contract Bidder of Record.

D. Location of material, equipment, devices and appliances shown in the Contract Drawings are approximate and are subject to such revisions as may be necessary or desirable at the time the work is installed. Install the work in relation to existing conditions and be responsible for the correctness of the work with reference to finish elevations and surrounding conditions.

E. The Contract Documents show the general arrangements of the work. Should project conditions require any rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, the Contractor may, before proceeding with the work, prepare and submit five copies of shop drawings of the proposed rearrangement for the Architect's review.

F. If the Contractor proposes to install equipment requiring space conditions other than those shown,theyshall assume responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accompanied by shop drawings of the space affected.

G. The accompanying Drawings do not indicate the existing electrical installations other than to identify modifications and extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installations and/or installing any new or temporary work under this Division.

1.03 CODES AND STANDARDS

A. Execute the work in accordance with local, state and national codes, ordinances and regulations having jurisdiction or authority over the work. Make any and all adjustments required by these agencies without further cost to the Owner. In addition, conform to the applicable provisions and recommendations of the following standards:
   1. National Electrical Manufacturer Association (NEMA)
   2. American Society for Testing and Materials (ASTM)
   3. National Fire Protection Association (NFPA)
   4. National Electrical Safety Code (NESC)
   5. Institute of Electrical and Electronic Engineers (IEEE)
   6. National Electrical Code (NEC)
   7. Underwriters' Laboratories (UL)
   8. American National Standards Institute (ANSI)
   9. International Building Code (IBC)
   10. Occupational Safety and Health Administration (OSHA)
   11. Americans with Disabilities Act (ADA)

12. Applicable utility companies
13. Texas Accessibility Standards (TAS)
14. International Energy Conservation Code (IECC), including local amendments

B. Execute the work in accordance with the most current codes and standards in effect at the time of bidding.
C. In the event standards and codes conflict with each other, the most stringent shall apply.
D. Conform to National Electrical Code rules. Provide material and equipment, which is approved by Underwriter's Laboratories, bears UL label and is acceptable to Factory Mutual.
E. It is specifically understood, however, that in those instances where capacities, sizes, etc., of electrical equipment, devices or material as designated in these Specifications or on the Drawings are in excess of the minimum requirements of the National Electrical Code, such designated capacities shall prevail.

1.04 COMMISSIONING

A. The Contractor shall provide all system commissioning services as required by section C408 of the 20__ International Energy Conservation Code (IECC). Electrical power and lighting systems shall comply with IECC section C405.
B. Commissioning, as outlined in IECC section C408 shall include the following:
   1. A commissioning plan.
   2. Functional performance testing for all lighting controls.
   3. A preliminary commissioning report.
   4. Final documentation including drawings, O&M manual(s), T&B report, and final commissioning report.

PART 2 PRODUCTS

2.01 SUBMITTALS AND SHOP DRAWINGS

A. Definitions:
   1. Submittal - Equipment, Product Data, and Material Information for components proposed to be installed for the project.
   2. Shop Drawing - Scaled floor plans showing equipment layout and elevations of proposed components to be installed for the project.
B. Submit Submittals for all material furnished under this division of the work. Refer to the General Requirements for additional requirements. In addition to the quantity of Shop Drawing copies required by the General Requirements, furnish one additional copy for the Electrical Engineer's file. No material shall be fabricated, delivered to the jobsite, or installed which the Architect through Shop Drawing submittals has not approved.
C. The submittals shall include sufficient descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements; catalog numbers alone will not be acceptable. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts.
D. Deliver Submittals to the Architect in sufficient time to avoid delay of the project. Group Division 26 submittals as identified below, submit sections not included in these groupings separately. The Electrical Contractor shall acknowledge receipt of all Division 23 mechanical equipment submittals and confirm the overcurrent protection requirements of the project specific HVAC equipment has been coordinated with the distribution equipment prior to submitting for approval. All proposed changes to the overcurrent protection devices shall be clearly identified in the distribution equipment submittal.
   1. Distribution Equipment – Low Voltage
      a. Section 26 24 16 - PANELBOARDS
      b. Section 26 24 17 - DISTRIBUTION PANELBOARDS
      c. Section 26 27 16 - Cabinets
      d. Section 26 28 16 - Overcurrent Protective Devices
      e. Section 26 28 17 - Disconnect Switches
      f. Section 26 43 13 - SURGE PROTECTION DEVICES (SPDs)
   2. Generation Equipment

a. Section 26 32 13 - GENERATOR SYSTEM
b. Section 26 36 23 - AUTOMATIC TRANSFER SWITCHES

3. Lighting
   a. Section 26 09 24 - Occupancy Sensors
   b. Section 26 09 27 - Lighting Control System
   c. Section 26 51 13 - Lighting

E. Submit samples for approval when requested by the Architect.

F. Before submitting Submittals for review, examine them and verify that they correctly represent the material or equipment intended for this project. The Contractor's review of Shop Drawings is not intended to take the place of the review of the Architect, and Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.

G. List deviations and exceptions from the specified equipment in writing and submit Shop Drawings as required by this section. Shop drawings must be submitted if proposed equipment differs in physical size than specified equipment to indicate proposed equipment has been coordinated with other trades and space allocated for this equipment. Shop Drawings must be at a 1/4" per foot scale indicating proposed equipment layout and any other equipment/materials noted in that general area. Other equipment may include, but is not limited to, HVAC equipment/materials noted in that general area. Other equipment may include, but is not limited to, HVAC equipment/ductwork, plumbing equipment/piping, light fixtures, structural members, cabinetry, etc. Failure to do so will be cause for rejection of submittals. Contractor agrees that if deviations, discrepancies, or conflicts between Shop Drawing submittals and the Contract Documents are discovered either prior to or after Shop Drawing submittals are reviewed by the Architect, the Contract Documents shall control and shall be followed, unless deviations have been specifically approved by the Architect.

H. The review of Submittals or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from plans and specifications unless they have, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect thereon; nor shall it relieve them from responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect, they shall state in their letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

I. Contractor agrees that Submittals and Shop Drawings reviewed by the Architect are not change orders; that the purpose of Shop Drawing submittals by the Contractor is to demonstrate to the Architect that the Contractor understands the design concept, that they demonstrate their understanding by indicating which equipment and material they intend to furnish and install and by detailing the fabrication and installation methods they intend to use.

J. Failure to submit scaled Shop Drawings will indicate that the Contractor has coordinated their efforts with other trades and finds no conflicts with the work presented in the Contract Documents.

2.02 STANDARDS FOR MATERIALS

A. It is the intention of these specifications to indicate a standard of quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only the named manufacturer's products will be considered and the Contractor's bid shall be based on their product.

B. Where the phrase 'or approved equivalent' or 'or equivalent' or 'equivalent to' or 'accepted substitute' is used in these specifications, the names or name mentioned are to be used as a basis of quality. Other manufacturers will be considered if the quality of the proposed material is equivalent to that of materials named, in the opinion of the Architect. Such unnamed manufacturers' products will, however, be considered as substitutions and shall not be used as a basis for bidding.

C. Basis of quality shall include material, workmanship, weight, finishes, and gauges of material, appearances, capacity and performance. Manufacturer's representation as to availability of equipment, replacement parts and service personnel in the area will be a factor in consideration of submittals.

D. All materials shall be fully warranted.

E. Furnish standard products and manufacturers regularly engaged in production of such equipment.
F. Furnish manufacturer's latest standard design.
G. All equipment shall conform with applicable IEEE, UL, ANSI and/or NEMA Standards.
H. Obtain manufacturer's recommendations and instructions for all installed equipment including installation instructions, preparation cleaning, tests and preservice checks, and then ensure all have been performed prior to completion of work.

2.03 SUBSTITUTIONS

A. The Architect prior to installation shall approve substitutions of equipment. Substitution of equipment shall be in accordance with Division 01 of the specifications.
B. When alternate or substitute materials and equipment are used, the Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, and other apparatus and trades that may be affected by their use.
C. Contractor shall bear all additional costs resulting from the use of substituted materials. Such changes shall be at no additional cost to the Owner.

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate and direct the work under this division of the specifications with the work under other divisions of the specifications. Examine the Contract Documents and report any discrepancies between divisions of the work to the Architect and obtain written instructions for changes necessary in the work.
B. Before installation, make proper provisions to avoid interferences with the work under other divisions of the specifications. Changes required in the work of the Contractor caused by their neglect to do so shall be made by them at their own expense.
C. Harmonize the work under this division with the work under other divisions of the specifications such that it may be installed in the most direct and workmanlike manner without hindering, handicapping, or conflicting with the work under other divisions of the specifications. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation.

3.02 PERMITS AND FEES

A. Secure and pay for all necessary permits, licenses and inspections required by law for the completion of the Work. Secure and pay for all certificates of approval that are required and deliver them to the Architect before final acceptance of the Work.
B. If a utility company in connection with the work under this division makes any charges, the Contractor shall advise the Owner, so that the Owner can pay these charges. Advise the Owner of these charges in a timely manner, so as not to delay construction of the project.

3.03 QUALITY ASSURANCE

A. Use adequate quantities of skilled workers who are trained and experienced in their crafts and who are familiar with the specified requirements and methods needed to perform the work in this division.
B. Install materials and equipment based upon actual dimensions and conditions at the project site. Field measure for materials or equipment requiring exact fit.
C. Be responsible for the proper location and sizes of all slots, holes or openings in the building structure pertaining to the work in this division, and for the correct location of pipe sleeves.
D. Perform work in accordance with good commercial practice. The good appearance of the finished work shall be of equivalent importance with its operation.
E. Isolate all conduit, transformers and motors to insure an acceptable noise level free from objectionable vibration for all systems.

3.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Follow the manufacturer's directions in the delivery, storage and handling of equipment and materials.
B. Equipment and materials shall be tightly covered and protected against dirt, water, chemical or mechanical injury and theft. Damaged equipment will not be accepted.

C. After materials are installed, protect the installation until the work is completed and accepted by the Owner.

3.05 CLEANING UP

A. Remove all shipping labels, dirt, paint, grease and stains from all equipment under this division of the Work. Remove debris as it accumulates. Upon completion of the Work, clean all electrical equipment and the entire electrical installation in order to present a first class electrical installation suitable for occupancy. No loose parts, scraps, tools nor debris shall be left on the premises.

3.06 ELECTRICAL SERVICE FOR TESTING

A. Construct sufficient temporary electric service and connect to refrigeration machines, related pumps, fans, fan coil units, elevators and other equipment furnished under other divisions of the specifications such that the equipment installers may begin testing 30 workdays before job completion deadline.

B. Notify the electric utility company with sufficient time in advance so they can construct their portion of the permanent electric service entrance to this project. If the electric utility company indicates that permanent service will not be installed when needed, notify the Architect in writing immediately.

3.07 CUTTING AND PATCHING

A. Be responsible for the cost of cutting and patching required in connection with the work under this division of the specifications.

B. Coordinate the work to eliminate unnecessary cutting of construction. Where it becomes necessary to cut through walls, floors, ceilings and other construction to permit installation of the work, or to repair defective work under this division, the costs for such cutting and patching shall be included in this division of the work. Comply with other applicable divisions of the specifications concerning the quality of cutting and patching.

C. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

D. Cutting of structural members is not permitted unless the Architect grants specific written permission.

3.08 FLASHINGS, SLEEVES, INSERTS

A. Be responsible for maintaining the integrity of the waterproofing of conduit penetrations through roofs, exterior walls and floors.

B. Be responsible for the installation of counterflashing of roof penetrations to provide a weatherproof installation.

C. Install 22 gauge galvanized sheet iron sleeves for each conduit passing through floors. Extend sleeves 1-1/2 in. above the floor slab and cement watertight. The sizes of sleeves shall be installed to permit the subsequent insertion of the proper size conduits or raceways.

D. Install galvanized wrought iron pipe sleeves around conduits and raceways that pass through concrete beams or walls and masonry exterior walls. The inside diameter of these sleeves shall be at least 1/2 in. greater than the outside diameters of the service pipes. After the pipes are installed in these sleeves, fill the annular space between pipes and sleeves with mastic. The completed installation shall be watertight.

E. Be responsible for maintaining the fire rating of penetrations through walls, floors and ceilings.

F. Waterproofing and fireproofing work shall conform to the requirements of other applicable sections of the specifications.

3.09 FOUNDATIONS

A. Be responsible for the installation of steel reinforced concrete foundations below all floor-mounted switchboards, panelboards, motor control centers, transformers and other floor mounted electrical equipment.

B. Concrete foundations shall not be less than 4 in. high. All top edges shall be neatly chamfered.

C. Concrete foundations shall be 3 in. wider and 3 in. longer than the base of the equipment being installed.

D. All concrete work shall be steel reinforced with a minimum of 6 in. by 6 in., No. 6 mesh and shall conform entirely to the requirements of the other sections of the specifications describing this class of work.

E. Be responsible for the installation of steel reinforced concrete piers for pole-mounted lighting fixtures. Neatly chamfer top edges and conform to the requirements of the other sections of the specifications describing this class of work. Remove all form marks, burrs and imperfections from all exposed surfaces for a neat and appealing appearance.

3.10 PAINTING

A. Maintain original factory finish on all material and equipment installed under this division of the work unless specifically noted otherwise within the Contract Documents. Should the finish be marred in transit or during installation, it shall be re-finished to present a neat, workmanlike appearance. Leave equipment clean and free from any grease, dirt and rust and in a suitable condition for painting.

3.11 EXCAVATION AND BACKFILLING

A. Be responsible for all excavating and backfilling necessary for the installation of the work under this division. Include shoring and pumping in ditches to keep them in dry conditions until the work has been installed. Perform all shoring required to protect the excavation and safeguard employees.

B. Make excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Compact the ground under conduits before conduits are installed. Obtain approval of excavation routing from the Architect prior to executing the work.

C. Install exterior conduits with a minimum of 24 in. of cover below the finished grade, unless otherwise indicated.

D. Use selected soil for backfilling, free from rocks and debris, pneumatically tamped with 6 in. layers to secure a field density ratio of 90 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

E. Remove from the site excavated materials not suitable for backfill and not used in the backfill.

F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, they shall be repaired to make their operation equivalent to the existing condition before any trenching was started.

G. Replace concrete, curbs, paving and other surface improvements cut during excavation to their original condition. In a lime-stabilized area, the lime stabilization shall be fully restored after the excavation is complete.

H. Refer to Section 26 05 33 for marking underground electrical work.

3.12 IDENTIFICATION OF ELECTRICAL EQUIPMENT

A. Identify electrical equipment in accordance with the NEC, local authorities and in accordance with the requirements of the Contract Documents.

B. Use laminated three-ply, engraved plastic nameplates with black surface and white interior core, at least 1/16 in. thick. Engraved lettering shall be condensed gothic at least 1/4 in. high and properly spaced for legible and easy reading. Attach plates to equipment with chromium-plated screws. Adhesive attachment is not acceptable. Identify the following items with engraved nameplates, located as follows:

1. Each switch/fuse unit or circuit breaker in each main panel and each distribution panel - adjacent to switch/fuse unit or circuit breaker.
2. Spares shall be labeled 'Spare'.
3. Each branch circuit panel - on panel trim cover immediately above panel door.
4. Each safety switch, relay cabinet, time clock - on outside of cover. Include the power source on safety switches.
5. Each exhaust fan switch - custom engraved on outside of switch coverplate (high and low if required).
6. Each motor starter - on outside of cover.
7. Each motor starter in motor control center on outside of cover.
8. Outside light switches - custom engraved on outside of switch coverplate.
9. Any switch for load that cannot be seen from the control point - custom engraved on outside of switch coverplate.

C. Custom engraving on cover plates for items noted above shall be equivalent to custom engraving as performed by Hubbell, or accepted substitute.

D. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Each label shall show specific and correct information for specific equipment based on its arc flash calculations. Labels shall show the followings:
   1. Nominal system voltage.
   2. Equipment/bus name, date prepared, and preparer's name and address.
   3. Arc flash boundary.
   4. Available arc flash incident energy and the corresponding working distance.
   5. Minimum arc rating of clothing.
   6. Site-specific level of PPE.

E. Branch circuit panelboard directories shall be completely and properly typewritten, including room numbers. Room numbers and names shall be as finally designated at the jobsite.

F. Refer to other sections of the specifications for conductor color-coding requirements.

G. Refer to Section 26 05 33 for identifying of underground electrical work.

3.13 BALANCING OF PANELS

A. At the completion of the installation of the electrical system, check each phase of all panels under full load and arrange loads such that all phases carry the proper proportion of load. Submit load readings to Engineer for review as part of project close out documentation.

3.14 LOCKING OF ELECTRICAL FACILITIES

A. Provide padlocks for exterior electrical facilities subject to unauthorized entry.

B. Furnish locks to match Owner's locking system. Key all locks alike.

C. Furnish Owner with two keys per lock up to a quantity of ten keys.

D. Install locks immediately upon installation of electrical facility.

3.15 ACCESS DOORS

A. Wherever access is required in walls, ceilings, or soffits to concealed junction boxes, pull boxes or other electrical equipment installed under this division, provide and install access doors as indicated herein.

B. Furnish and install hinged access door and frame with flush latch handle as follows:
   1. Plaster surfaces - Milcor Style K, or accepted substitute.
   2. Ceramic tile or drywall surface - Milcor Style M (with 'B' label where required), or accepted substitute.
   3. Install panels in locations approved by the Architect and paint as directed.

3.16 RECORD DOCUMENTS

A. Job set: Promptly following receipt of the Owner's Notice to Proceed, secure from the Architect at no charge to the Contractor, one complete set of all Documents comprising the Contract.

B. Final Record Documents: At a time nearing the completion of the work, secure from the Architect at no charge to the Contractor one complete set of sepia transparencies of all Drawings in the Contract.

C. Maintenance of Job Set: Immediately upon receipt of the job set described in paragraph above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".

D. Preservation:
   1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for the new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect.
   2. Do not use the job set for any purpose except entry of new data and for review by the Architect, from start of transfer of data to final Project Record Documents.
   3. Maintain the job set at the site of Work where the Architect designates that site.

E. Making Entries on Drawings:
   1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
   2. Date all entries.
   3. Call attention to the entry by a 'cloud' drawn around the area or areas affected.
   4. In the event of overlapping changes, use different colors for the overlapping changes.
   5. All equipment shall be clearly indicated in its installed location. Exposed items or those easily accessible, as above lay-in ceilings, may be located to scale. Concealed items not readily accessible, such as underground piping, shall be located by dimension.

F. Transfer of Data to Final Project Documents:
   1. Approval of recorded data prior to transfer:
      a. Following receipt of the transparencies described above, and prior to beginning transfer of recorded data thereto, secure the Architect's approval of all recorded data.
      b. Make required revisions.
   2. Transfer of Data to Drawings:
      a. Carefully transfer change data shown on the job set of Record Drawings to the corresponding transparencies, coordinating the changes as required.
      b. Clearly indicate at each affected detail and other drawing a full description of changes made during construction, and the actual location of items described above.
      c. Call attention to each entry by drawing a 'cloud' around the area or areas affected.
      d. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.

G. Review and Submittal:
   1. Submit the completed set of Project Record Documents to the Architect as described above.
   2. Participate in review meetings as required.
   3. Make required changes and promptly deliver the final Project Record Documents to the Architect.

3.17 OPERATIONS AND MAINTENANCE DATA

A. Accumulate, as the job progresses, the following data, in duplicate, prepared in a neat brochure or packet folder, and deliver to the Architect for checking and subsequent delivery to the Owner.
   1. Manufacturers' warranties, guarantees, service manuals, and operating instructions for equipment and materials covered by this division of the specifications.
   2. Copies of approved Shop Drawings.
   3. Any and all other data and/or Drawings required during construction.
   4. Repair parts list of all major items and equipment including name, address, and telephone number of local supplier and agent.

3.18 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Architect to instruct representatives of the Owner in the complete and detailed operation of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a Letter of Release, acknowledged by the Owner or their Authorized Representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. Be responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, follow the written operating and maintenance manuals in all instances, and familiarize the Owner's personnel with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

3.19 LOCAL PARTS AND SERVICE

A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 150 miles of the project site".

3.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspection authority.

B. Upon final completion of the Work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

3.21 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, they may do so provided that they properly supervise the operation and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, clean the equipment properly; make required adjustments, and complete punch list items before final acceptance by the Owner.

B. The date of acceptance by the Architect, for beneficial use by the Owner, shall be the beginning date of the warranty period.

3.22 ACCEPTANCE OF THE WORK

A. The Work, when completed, will be accepted in a finished, perfect and undamaged state only. Provide for protection of the Work during its progress, and if damaged, do all patching or replacing necessary to its full and satisfactory completion.

3.23 WARRANTY

A. Furnish a written certificate, guaranteeing all materials, equipment and labor to be free of all defects for a period of one year from the date of final acceptance by the Owner of the Work, and guarantee that if any defects appear within the stipulated guarantee period, such work shall be replaced without charge.

B. This guarantee shall be extended to include the capacity and integrated performance of all component parts of the various systems.

C. Lamps for light fixtures shall be excluded from the guarantee requirements of this section.

3.24 FINALLY

A. It is the intention that this Specification provide a complete installation. Include all accessory construction and apparatus necessary to the operation and testing of the work under this division. The omission of specific reference to any part of the work necessary for such complete installation shall not relieve this Contractor from furnishing and installing such parts.

END OF SECTION 26 05 10

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Divisions 00 and 01 Specification Sections, apply to this Section.

1.02 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wire and cable systems as indicated in the Contract Documents.

1.03 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide conductors made of soft-drawn-annealed copper with conductivity not less than that of 98 percent pure copper. Conductors #12 gauge and smaller shall be solid. Conductors No. 10 gauge and larger shall be stranded.

B. Utilize conductors with insulation rated at 600 volts and insulated with type 'THHN' insulation in dry locations and type "THWN" in wet locations for conductors #1 gauge and smaller. Utilize conductors with insulation rated at 600 volts and insulated with type 'XHHW' insulation for conductors #1/0 gauge and larger. Wire in fixture channels and other special locations shall be as specifically rated for temperature in Article 300 in the NEC.

C. Minimum wire sizes shall be in accordance with other requirements of the specifications and as follows: For 20 ampere branch circuits #12 gauge, except that home runs greater than 50 ft. from the panel to the first outlet box on 120/208 volt shall be #10 gauge. Where home runs are greater than 100 ft. from the panel to the first outlet box, on 277-volt circuits wire shall be #10 gauge.

D. All wire shall be color-coded. Mark conductors on each end with a 1 in. band of colored pressure-sensitive plastic tape or by the use of brilliant waterproof lacquer, applied according to manufacturer's instructions. Colors for each phase and the neutral shall be consistent throughout the system in accordance with the requirements of this section.

E. Conductor sizes shown on the Contract Documents are selected based upon use with 75 degrees C terminations. Furnish terminations, which are UL listed for 75°C, or derate conductors for use at 60°C. Use of 90°C terminations is acceptable, but conductor must be sized at the 75°C rating. Do not use 90°C rating for conductors.

F. Armored cable types AC and BX are specifically not allowed.

G. Armored cable type MC is allowed for the following applications only:

1. Where installed within existing wall cavities to a point 12 inches maximum above the top of the wall.
2. Where installed above existing unaccessible ceilings to points 12 inches maximum beyond the edges of the existing ceiling.
3. Where installed in accessible ceiling spaces in lengths not exceeding six feet if allowed by local building codes.
4. Branch circuit wiring. However, MC cable may not be used for homeruns.

H. Armored cable type MC: Galvanized, interlocking steel sheath. 90°C, 600V copper conductors with THHN/THWN insulation. Insulated copper conductor ground wire.

PART 3 EXECUTION

3.01 GENERAL WIRING METHODS

A. Place an equivalent number of conductors for each phase, neutral and ground of a circuit in same raceway or cable.

B. Do not share neutral conductors between branch circuits connected to single pole circuit breakers unless shown otherwise on drawings.

C. Splice only in junction or outlet boxes.
D. Neatly train and lace wiring inside boxes, equipment, and panelboards.
E. Make conductor lengths equal for parallel circuits.
F. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling #4 gauge and larger wires.
G. When inserting conductors in raceways, comply with the following:
   1. Raceways shall first be installed as a complete raceway system without conductors.
   2. Do not install pull wires and conductors until the raceway system is in place.
   3. Do not use cleaning agents and lubricants that have a deleterious effect on the conductors.
   4. Completely and thoroughly swab raceway system before installing conductors.

3.02 PHASING

A. Identify wire and cable for feeders and branch circuits for general power and lighting with a visible color code in accordance with the requirements of this section as follows:

120/208 Volt	277/480 Volt
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	

B. Provide green or bare grounding conductor identification for grounding conductors. Identification of all ungrounded conductors at junction boxes, wireways, and/or terminations may be by means of colored tape or painting when color-coded conductors as specified above are not available.
C. Phasing of the complete electrical installation shall be connected and maintained the same throughout the power distribution system. Where the project is an addition or modification to an existing facility, the electrical distribution system phasing shall be made the same as the existing.
D. Switchgear, safety switches, motor starters, plug-in type bus duct, lighting and power panels and power receptacles shall have all the same phase arrangements throughout the facility.

3.03 INSTALLATION

A. Install conductors in a neat and workmanlike manner to meet code requirements and make runs continuous without weld, splice, or joint between boxes. Do not install wires in conduit unless the entire system of conduit and outlet boxes is permanently in place. Pull conductors using a UL approved wire lubricant.
B. Provide conductors continuous from outlet to outlet with no splices except at outlets. Leave sufficient wire at all outlets to make connections without straining.
C. Deliver cable and wire to the project in original packages. Conductors with insulation showing deterioration within one year after final completion and acceptance of the Work shall be removed and replaced at no cost to Owner.
D. Thoroughly clean wires before installing lugs and connectors.
E. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
F. Terminate spare conductors with electrical tape.
G. Torque test conductor connections and terminations to manufacturer's recommended values.
H. Where outlets only are indicated, leave 48-in. leads of conductors, for connection to equipment. Identify all conductors' circuit numbers with Brady tape at terminals and junctions.
I. Where more than three current-carrying conductors are installed in a raceway, use larger size conductor and appropriate larger size raceway to comply with Article 310 of the National Electrical Code.
J. Where conductor is installed in an environment where the ambient temperature will exceed 86°F, use larger size conductor and appropriate larger size raceway to comply with Article 310 of the National Electrical Code.

K. Test all circuits for grounds. Light and test each lamp. Prove and test energy available at the load side of disconnect switches and at the final point of connection to driven equipment. Make all necessary and reasonable tests as required by the Architect to prove the integrity of work and leave the complete electrical installation ready for operation.

L. Where MC cable is allowed for use on this project in Part 2 of this specification section:
   1. Install MC cable in accordance with NEC, Article 330.
   2. Provide fittings UL listed for use with MC cable.

END OF SECTION 26 05 19

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PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wire connections and devices systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Make cable and wire connections for splicing or terminating with compression deforming type connectors as manufactured by Burndy Corp., Thomas & Betts Co., Inc., Dossert Manufacturing Corp., Ilsco Corp., or accepted substitute. Connectors for cable sizes 250 Kcmil and larger shall be the long barrel type for double indentation. Soldered connections will not be permitted. Twist-on insulated connectors, of proper size, and resistant to vibration, may be used. Use twist-on connectors as manufactured by Minnesota Mining and Manufacturing Co., Thomas & Betts Co., Inc., Ideal Industries, Inc., or approved equivalent.

B. Provide terminal connectors with the hole sizes and spacing in accordance with NEMA standards. Provide terminal connectors with two holes in tongue for use on conductor sizes 250 Kcmil and larger. Terminal connectors are not required for connections to the circuit breakers in the lighting and/or receptacle panels.

C. Insulate connections made with non-insulated connectors with three layers of plastic tape, each layer being half-lapped. Use No. 35+ plastic tape as manufactured by Minnesota Mining and Manufacturing Co., or similar and equivalent plastic tape as manufactured by Plymouth Rubber Co.

PART 3 EXECUTION

3.01 INSTALLATION

A. Make all electrical power and control connections to equipment furnished under other divisions of the specifications and furnish wiring, conduit, outlet boxes, disconnect switches, etc., as required for same. Check General Construction, Controls, Plumbing, Heating, and Air Conditioning, etc. plans and specifications to determine the amount of such wiring required and include cost of same in bid. Verify locations, horsepower, voltages, etc., of all equipment as the job progresses. If a conflict arises in wiring, ask the Engineer immediately for clarification.

B. Provide branch circuits and connections to all motors furnished to this project. Provide all disconnect switches as shown and where required by national or local codes. In general, all wiring shall be in conduit, with a short section of flexible conduit at each motor. Securely attach conduit to flexible conduit. When the motor is an integral part of equipment, isolate with a short section of flexible metal conduit to prevent vibration and/or noise amplification to the building structure. If the motor is adjustable, an additional length of flexible metal conduit shall be installed at the motor. Connect a ground wire from the conduit termination to the motor frame on the inside of the flexible conduit. Use approved grounding lugs or clamps on the conduit connection.

C. Branch circuits and connections to all electrically operated equipment are included in this contract, whether or not specifically mentioned. Check, on the job, for further details on Plumbing, Heating, and Air Conditioning equipment as project progresses. Ground equipment in an approved manner.

D. Major equipment furnished under the mechanical and other sections of the specifications may require different rough-in requirements than indicated on the plans due to the 'or equivalent' equipment clause. Secure detailed drawings from the trade furnishing the equipment to determine actual rough-in locations, conduit and conductor requirements.

E. Before connecting equipment, check the nameplate data against the information shown on the Drawings. Call any discrepancies to the attention of the Architect.

END OF SECTION 26 05 20

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of a grounding system as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

1.03 TESTS

A. Measure ground grid resistance with earth test megger and install additional ground rods and conductors as required until resistance to ground complies with Code requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide a grounding system that includes all connections and testing of ground rods, ground cables, ground buses, conduits, fittings, anchors, supports, thermite process materials and equipment, and other materials as required for a complete installation.

B. Provide ground cables composed of stranded bare copper of 98 percent conductivity encased in conduits above grade, or buried to a depth not less than 12 in. below grade. Install as required to provide sufficient mechanical protection.

C. Provide Thomas & Betts Co., Inc., Catalog No. 3951, or approved equivalent, ground fittings for bonding ground cable to its encasing conduit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ground electrical work in accordance with NEC Article 250, local codes as specified herein, and as shown on the Drawings.

B. Install ground cables continuous between connections. Splices will not be allowed except where indicated on the Drawings. Where ground cables pass through floor slabs, building walls, etc., and are not in metallic enclosures, provide with sleeves of approved nonmetallic material.

C. Use rigid metal conduit and electrical metallic tubing as equipment grounding conductors. Make-up couplings wrench tight. Install grounding conductor in nonmetallic raceways and under floor ducts.

D. Install equipment-grounding conductors in nonmetallic raceways. Install equipment grounding conductors in metallic raceways where noted on the drawings.

E. Ground interior lighting fixtures with grounding conductor to rigid metal raceways serving them. Flexible metal conduit in lengths less than 6 ft. 0 in. may be used as grounding conductors when terminated with approved fittings on circuits of 20 amperes or less.

F. Where connections are made to motors or equipment with flexible metal conduit, grounding conductor shall be stranded copper conductor within the conduit, bonded to the equipment and to the rigid metal raceway system. Size conductor in accordance with NEC, Article 250.

G. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of No. 12 wire with green colored insulation to connect to the grounding terminal of the receptacle. Grounding clip shall be equivalent to Steel City Type G. This requirement may be deleted if automatic grounding clip receptacle meeting NEC Article 250.

3.02 COMMUNICATION GROUNDING

A. Telephone:
   1. Provide one No. 4 THW to main service ground bus from each telephone equipment room. Leave 12 in. pigtail at telephone board.

B. Fire Alarm and Detection:
   1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

C. Television Distribution System:
   1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

D. Public Address System:
   1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

3.03 COORDINATION

A. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION 26 05 26

PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Provide labor, materials, services, equipment and appliances required in conjunction with sealing of penetrations as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Samples: Provide samples upon written request.
B. Product Data: Manufacturer's specifications and installation instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Acceptable Manufacturers:
   1. Caulk and Putty: 3M's No. CP-25 and No. CP-303 synthetic elastomers.
   2. Wrap/Strip: 3M's No. FS-195 organic/inorganic, fire resistive sheet with aluminum foil on one side.
   3. Composite Sheet: 3M's No. CS-195 organic/inorganic fire resistive elastomeric sheet, bonded on one side with 28-gauge galvanized steel and the other side with reinforced hexagonal shaped steel wire mesh and covered with aluminum foil.
   4. Thunderline Model "LS/Link-Seal" seals, of the required size and number of links, shall be used on all conduit penetrations of exterior walls. Similar fittings by O.Z./Gedney shall be considered approved equivalents.

2.02 ROOF PENETRATION SYSTEMS

A. General: Construct roof penetration systems utilizing the “Alumi-Flash” system by Portals Plus, Inc., or equal by Thy-Curb.
B. Each roof penetration shall include a spun aluminum base (“High” size if required due to the existing roof construction and any insulation thickness) and an EPDM rubber cap. Each rubber cap shall have a pre-molded pipe opening and shall be selected based on the actual pipe or conduit size required at each location. Secure each rubber cap to each pipe or conduit with the manufacturer’s recommended stainless steel gear clamp.
C. Manufacturer: Subject to compliance with requirements, provide roof penetration systems of one of the following:
   1. Portals Plus, Inc.
   2. Thycurb Div.; Thybar Corp.

PART 3 EXECUTION

3.01 INSTALLATION

A. Review the detailed requirements of the UL through penetration fire stop assembly to be used and verify dimensional requirements such as maximum conduit size, conduit spacing, maximum opening size, minimum length of sleeve, etc.
B. For sealing of sleeves on or below grade and in wet locations, install link seals around all conduit penetrations properly sealing the annular space between the sleeve and the conduit to provide a waterproof seal.
C. For sealing of sleeves above grade and in dry/damp locations, use specified fire stop material and install per manufacturer's instructions and in conformance with UL requirements.
D. Attach an adhesive warning label identifying the fire stop assembly and warning against removal without proper resealing.
E. Seal floor, wall and ceiling penetrations or fire rated assemblies in above grade and in dry/ damp locations, both horizontal and vertical, utilizing intumescent (expand when heated) materials designed to be applied as a fire, cold smoke, noxious gas, and water sealant. Penetrations shall meet the requirements of ANSI/UL 1479 "Fire Tests of Through-Penetration Firestops".

END OF SECTION 26 05 27

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PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Furnish all labor, materials, services, equipment and appliances required in conjunction with installation of supporting devices as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Product Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Kindorf
B. Unistrut
C. Superstrut
D. Powerstrut

2.02 MATERIALS

A. Continuous slotted channel: 12 gauge steel with electro-galvanizing and gold zinc dichromate barrier bases and dimensions as required for application.
B. Hanger rods: Continuous thread, electro-galvanized, steel, with gold zinc dichromate barrier, sizes as required for loads imposed.
C. Hex head cap screws and nuts: No. H-113 and No. 114, respectively.
D. One-hole pipe straps: Series HS-100, galvanized steel.
E. Single bolt channel pipe straps: Steel, with machine screw and nut, Series C-105 and Series C-106.
F. Lay-in pipe hanger: Series C-149.
G. Conduit and pipe hanger: Series 6H.
H. Beam clamps: Series 500, RC, EC and PC as applicable.
I. Concrete inserts, spot: Series D-256 or D-255.
J. Concrete inserts, channel: Series D-980 or Series D-986.
K. Riser clamps: Series C-210.
L. Cable supports: O.Z./Gedney Type S.

PART 3 EXECUTION

3.01 INSTALLATION

A. Carefully lay out supporting devices to coordinate with the work under other divisions of the specifications.
B. Securely fasten and support conduits and raceways to the building structure.
C. Suspend horizontal runs of conduits and raceways from the floor and roof construction by rod hangers spaced 10 ft. or less on centers for sizes 2-1/2 in. and greater, and 9 ft. or less on centers for 2 in. and smaller.
D. Fasten single runs of conduit to the structure with one-hole pipe straps and beam clamps or hang on rod hangers.
E. Support multiple runs of conduit and raceways from continuous channel inserts or from trapeze hangers constructed of rod hangers and channels.
F. Fasten single conduits to rod hangers with adjustable lay-in pipe hangers or for conduits of sizes 2 in. and smaller with Series 6H pipe hangers.
G. Fasten conduits to channels with pipe channel straps.
H. Support conduits and raceways within 3 ft. of each bend, of each termination, and at other intervals to maintain horizontal and vertical alignment without sag and deformation.
I. Do not use cable, strap, or wire hangers and fasteners.
J. Provide riser clamps for conduits at floor lines. Provide wire and cable supports in pull boxes for risers in accordance with NEC.

K. Install supports to permit equivalently distributed expansion and contraction of conduits and raceways with expansion joints. Use guides consisting of saddles, U-bolts and anchors designed for equivalent effectiveness for both longitudinal and transverse thrusts. Submit complete details for review.
L. Do not support conduits and raceways from equipment connections.
M. Provide special supports with vibration dampers to minimize transmission of vibrations and noises, where required.
N. Provide hangers, racks, cable cleats, and supports for wires and cables in cable chambers and other locations to make a neat and substantial installation.
O. Provide steel angle and channel supports to the floor and structure for panelboards, cabinets, pull and junction boxes. Provide independent support from entering conduits and raceways.
P. Provide supports as specified for conduits and raceways for outlet boxes and pull boxes 100 cubic in. and smaller.
Q. Paint all cuts, breaks, welds and other points where the rust inhibiting coating of supports is damaged.
R. Provide supports sized for the ultimate loads to be imposed.
S. Anchor supporting devices with:
    1. Wood screws on wood.
    2. Toggle bolts on hollow masonry.
    3. Bolts and expansion anchors in concrete or brick.
    4. Machine screws, threaded rods and clamps on steel.
T. Provide supports with hot-dipped galvanized finish in outdoor and wet locations.
U. Pipe and conduit supports:
    1. Single run pipe and conduits, 2-1/2 in. O.D. and less, shall have Type SS-8R/SS-8C as manufactured by Portable Pipe Hangers, Inc., or approved equivalent, spaced at maximum eight ft. on center and installed on roof pads if required by the roofing manufacturer.
    2. Multiple run pipe and conduits larger than 2-1/2 in. O.D. shall have Type PS, PSE, PP-10 with Roller, or PP-10 with Bar, as manufactured by Portable Pipe Hangers, Inc., or approved equivalent, spaced at maximum eight ft. on center and installed on roof pads if required by the roofing manufacturer. All conduits shall be held in place with clips on bars.

END OF SECTION 26 05 29

PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of pull and junction boxes as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pull boxes and junction boxes used on concealed runs of conduit in walls and over ceilings shall be of code gauge galvanized steel with sheet steel covers. Pull boxes in floors shall be of galvanized malleable cast iron, with gasketed covers. Exposed pull boxes or junction boxes installed outdoors shall be weatherproof and shall be provided with watertight gasketed covers fastened with corrosion resistant screws.

B. Pull Boxes and Junction Boxes: Metal construction conforming to National Electrical Code, with screw-on or hinged cover. Use hinged cover for boxes larger than 12 in. in any dimension.

C. Flush-Mounted Pull Boxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Use separate pull boxes and junction boxes for electric power, control, lighting, computer and communication systems.

B. Install pull boxes and junction boxes where required by the National Electrical Code and wherever required to overcome mechanical difficulties.

C. Install pull boxes in interior conduit at not more than 100 ft. apart when junction or outlet boxes do not break conduit runs.

D. Size pull boxes and junction boxes to best meet the needs of the particular situation and/or location and to comply with the National Electrical Code.

E. Coordinate the work in this section with the work under other divisions of this specification.

END OF SECTION 26 05 32

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PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment, and appliances required in conjunction with the installation of conduit systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications and product data for products to be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Metal Conduit: Heavy-wall, mild steel tube with metallic corrosion-resistant coating on interior and exterior, hot-dipped galvanized, free from defects and manufactured in accordance with ANSI standards, and UL listed.

B. PVC Coated Rigid Metal Conduit:
   1. Hot dip galvanized inside and out. Factory-cut threads shall be protected with hot galvanized threads and a clear urethane coating. Thread protectors shall be used on the exposed threads. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid galvanized steel conduit. The PVC coating shall be gray, 40 mils in thickness, continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes and manufactured in accordance with UL 6 Standard for Safety, Rigid Metal Conduit.

C. Electric Metallic Tubing (EMT): Welded steel tubing formed of low carbon steel, electro-galvanized exterior, inside coated with a thick, baked, tough elastic low-friction coating of enamel, and UL approved.

D. Intermediate Metal Conduit (IMC): Manufactured in accordance with UL 1242 with interior coating of silicone epoxy ester lubricant.

E. Flexible Metal Conduit: Single strip helically wound interlocking galvanized steel, UL listed; provide liquid tight with extruded polyvinyl jacket in damp and wet locations and in kitchens.

F. Rigid Nonmetallic Conduit:
   1. Direct buried - Schedule 40, UL listed.
   2. Concrete encased - Schedule 20, UL listed.

G. Elbows and Bends:
   1. Rigid nonmetallic conduit systems - PVC coated rigid metal conduit.
   2. Other conduit systems - same material as the conduit with which they are installed.

H. Bushings:
   1. 1-1/4 in. and smaller - high-impact thermosetting phenolic insulation, 150°C, O-Z/Gedney Type A.
   2. 1-1/2 in. and larger - hot-dipped galvanized with thermosetting phenolic insulation, 150°C, O-Z/Gedney Type B.

I. Locknuts:
   1. 1-1/4 in. and smaller - zinc-plated heavy stock steel, O-Z/Gedney.
   2. 1-1/2 in. and larger - cadmium-plated malleable iron, O-Z/Gedney.

J. Hubs: Cadmium-plated malleable iron, tapered threads, neoprene 'O' ring, insulated throat, O-Z/Gedney.

K. EMT Connectors: Compression type, zinc-plated steel body, cadmium-plated malleable iron nut, insulated throat, O-Z/Gedney.

L. EMT Couplings: Compression type, zinc-plated steel body, O-Z/Gedney.

M. Liquid tight Conduit Connectors: Cadmium-plated malleable iron body and nut, cadmium plated steel ferrule, insulated throat, integrally-cast external ground lug, O-Z/Gedney Type 4QL.

N. Through-Wall and Floor Seals: Malleable iron body, oversize sleeves, sealing rings, pressure clamps and hex-head cap screws, O-Z/Gedney Type FSK.

O. End Bells: Hot-dipped galvanized, threaded, malleable iron, O-Z/Gedney Type TNS.

P. Expansion Fittings: Hot-dipped galvanized, malleable iron with bonding jumpers.
   1. Linear - O-Z/Gedney Type AX or TX.
   2. Linear with deflection - O-Z/Gedney Type AXDX.
Q. Escutcheons: Chrome-plated sectional floor and ceiling plates, Crane No. 10.
R. Accessories: Reducers, bushings, washers, etc., shall be cadmium-plated, malleable iron of the forms and dimensions best suited for the application.
S. Identifying Tape for Buried Conduits: 6 in. wide, polyethylene, with printing continuous along length of tape, Brady Identoline.
   1. For buried electric power conduits- red with black letters.
   2. For buried electric communication conduits - orange with black letters.

PART 3 EXECUTION

3.01 INSTALLATION

A. Size conduits as indicated on the Contract Drawings and as required by the National Electrical Code for the quantity and sizes of wires to be installed in the conduit. Do not use conduit sized less than 3/4 in. unless specified otherwise.
B. No more than one, three-phase circuit or three, single phase circuits may be placed in a single conduit, unless specifically noted on the drawings as such.
C. Conceal conduits from view in all areas except mechanical and electrical rooms and crawl spaces. Should it appear necessary to expose any conduit:
   1. Bring it to the attention of the Architect immediately and obtain Architect's approval for location of exposed conduit.
   2. Rearrange the work to facilitate an approved installation.
D. Install conduits at elevations to maintain headroom and at locations to avoid interference with other work requiring grading of piping, the structure, finished ceiling, walls, access panels, etc. Avoid crossing other work.
E. To prevent displacement, securely support conduits to be concealed in the building structure and installed in advance of other work. Carefully lay out conduits installed within the structure, such as floors, beams, and walls to avoid densities excessive for the construction.
F. Install conduits imbedded in structural slabs in the middle of the slab below the top and above the bottom reinforcing steel. Maintain a minimum 1-1/2 in. concrete cover except where penetration into the slab is made. Do not install conduit larger than 1 in. in slabs.
G. Ream, remove burrs, and swab inside conduits before pulling in conductors.
H. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.
I. Make bends and offsets in 1 in. and smaller conduits with approved bending devices. Do not install conduits, which have had their walls crushed, deformed or their surface finish damaged due to bending.
J. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best suited for the application.
K. Make conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in areas where moisture may subsequently be present in a manner to avoid creating moisture traps; where unavoidable, provide junction box with drain fitting at conduit low point.
L. Install insulated throat threaded hubs on conduits entering enclosures without threaded hubs in wet and damp locations.
M. Install and neatly rack exposed conduits parallel with and perpendicular to building walls. Provide space for 25% additional conduit. Do not install exposed diagonal conduit runs.
N. Route and suspend conduits crossing expansion joints to permit expansion, contraction, and deflection utilizing approved fittings to prevent damage to the building, conduits, and supporting devices.
O. Do not install conduits exposed on the roof unless approval is obtained prior to installation.
P. Route conduit through roof openings for piping and duct-work where possible; otherwise, route through roof penetration system as specified in Section 26 05 27 - {\t\#1000008}.

Q. Do not place conduits in close proximity to equipment, systems and service lines, such as hot water supply and return lines, steam pipes, which could be detrimental to the conduit and its contents. Maintain a minimum of 3 in. separation, except in crossing, which shall be a minimum 1 in.

R. Connect motors, equipment containing motors, equipment mounted on isolated foundations, transformers and other equipment and devices which are subject to vibration and which require adjustment, with flexible metallic conduit from the device to the conduit serving it. Restrict length of flexible conduit to 6 ft. maximum unless specifically instructed in writing otherwise by the Architect. Provide secure supports at the points of attachment on each side of the connection. Use bonding jumpers as directed by the National Electrical Code and other sections of these specifications.

S. Install escutcheons on sight exposed conduits passing through interior floors, walls, and ceilings in finished spaces

T. Install fire seals on conduits passing through fire-rated partitions, floors and ceiling.

U. Install through-wall seals on conduits passing through exterior walls or use standard galvanized steel pipe sleeves, diameters 1/2 in. greater than the outside diameter of the sleeved conduit and fill the annular space with mastic.

V. Install sleeves for conduits passing through interior floors.

W. Install insulated throat grounding bushings on conduits stubbed through slabs and foundations into electrical enclosures.

X. Provide grounding of conduits, fittings and accessories. Refer to grounding section of specifications.

Y. Feeder Circuits:
   1. Install rigid metal conduit in damp and wet locations, in concrete slabs, and where exposed in mechanical and electrical equipment rooms and crawl spaces.
   2. Install flexible metal conduit where specified above and where permitted by the authorities having jurisdiction. Use liquid tight flexible metal conduit in damp and wet locations, where exposed in mechanical and electrical equipment rooms, and in kitchen and shop areas.
   3. Exterior to the building and below grade, bury Schedule 40 nonmetallic conduit, where permitted by the authorities having jurisdiction. If not permitted, use rigid steel conduit in accordance with installation requirements stated below. Elbows and bends greater than 30 degrees shall be rigid steel with PVC coating or wrapped with half-lapped, 0.20 inch thick, self-sticking, anti-corrosive PVC pipe wrapping tape. Vertical extensions from the elbow to above grade or slab shall be rigid steel with PVC coating or wrapping tape.
   4. Exterior to the building and above grade, use rigid steel conduit and for elbows and bends greater than 30 degrees.

Z. Branch Circuits:
   1. Install rigid metal conduit in damp and wet locations, in concrete slabs, and where exposed in crawl space.
   2. Install electrical metallic tubing where concealed by building structure and where exposed in mechanical and electrical equipment rooms.
   3. Exterior to the building and below grade, bury Schedule 40 nonmetallic conduit, where permitted by the authorities having jurisdiction. If not permitted, use rigid steel conduit in accordance with installation requirements stated below. Elbows and bends greater than 30 degrees shall be rigid steel with PVC coating or wrapped with half-lapped, 0.20 inch thick, self-sticking, anti-corrosive PVC pipe wrapping tape. Vertical extensions from the elbow to above grade or slab shall be rigid steel with PVC coating or wrapping tape.
   4. Exterior to the building and above grade, use rigid steel conduit and for elbows and bends greater than 30 degrees.
   5. Install flexible metal conduit where specified above and where permitted by the authorities having jurisdiction. Use liquid tight flexible metal conduit in damp and wet locations, where exposed in mechanical and electrical equipment rooms, and in kitchen and shop areas. Limit flexible conduit to a length of 6 ft. maximum unless specifically instructed otherwise, in writing, by the Architect.

END OF SECTION 26 05 33

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PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of outlet boxes as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2 in. male fixture studs where required.
B. Cast Boxes: Cast metal, deep type, gasketed cover, threaded hubs. Use cast boxes for damp and outdoor installation.
C. Provide boxes with plaster ring where required. Boxes for installation in masonry walls shall be special square corner masonry type.
D. Furnish boxes with proper covers and device plates.
E. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight. Cast metal box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

2.02 FLOOR BOXES

A. Single Service (Power, data, telephone, etc.)
   1. Ground level and below: round, cast iron, fully adjustable, Hubbell #B2537 with brass cover and threaded outlets #S3725 for flush outlets and #SC3099/98 series pedestal for surface receptacles. Use #SC309D for single duplex receptacle and #SC309B for back or blank face. Use SB3182 brass carpet flange in areas that have carpet.
   2. Above ground level: round, galvanized steel, fully adjustable, Hubbell #B2529 with covers and fittings as described in 2.2.A.1 above.
   3. Ground level and below; telephone and other communication outlets: round, cast iron, fully adjustable, Hubbell #B2536 with brass cover and threaded outlet #S2525 cover for flush outlet and #SC3099/98 series pedestal and SS309T for telephone single outlet. Use #SB3182 brass carpet flange in areas that have carpet.
   4. Above ground level; telephone and other communication outlets: round, galvanized steel, fully adjustable, Hubbell #B2529 with covers and fittings described in 2.2.A.3 above.
B. Multiple Service (Power, data, telephone, etc.)
   1. Rectangular, cast iron, fully adjustable with number of gangs as shown on plans, Hubbell #B4000 series with brass cover and threaded outlets #S3625. Use SB308X series brass carpet flange in areas that have carpet.

2.03 RECESSED TELEVISION OUTLET BOXES

A. Multiple Service (Power, data, cable, etc.)
   1. Recessed three gang box with molded rectangular cut-out and fram. Metal mounting brackets and steel power outlet box. Frame accepts standard size wiring device coverplates, Pass & Seymour #TV3WMTVSS. Color to match wiring devices.

PART 3 EXECUTION

3.01 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the Drawings, and as required for splices, taps, wire pulling, equipment connections and code compliance.

B. Determine from dimensions shown on the Contract Documents and by actual measurements on the site, the exact location of each outlet. Outlet locations shall be modified from those shown on the plans to accommodate changes in door swings, space changes or to clear other interferences that arise or from job modifications. Make such modifications at no cost to the Owner as a matter of job coordination. Coordinate job conditions and notify the Architect of discrepancies before proceeding with the installation of the work. Set wall boxes in advance of wall construction blocked in place, and secure. Set wall boxes flush with the finish. Install extension sleeves as required to extend boxes to finished surfaces.

C. The locations of equipment and outlets shown on the Contract Documents are approximate. Check and verify exact locations in the field. Coordinate installation with the Architect and with the work under other divisions of the specifications.

D. Unless otherwise noted, location of outlet boxes, measured to centerline of box, shall be as follows:

	EQUIPMENT OR OUTLETS	ELEVATION
		(ABOVE FINISHED FLOOR)
	Toggle Switches	3 feet - 10 inches
	Fire Alarm Pull Stations	3 feet - 10 inches
	Receptacles	1 foot - 6 inches
	Clock and Clock Outlets	7 feet - 6 inches
	Fire Alarm Audible or Audible/Visual Devices	6 feet - 8 inches to bottom of device
	Combination motor starters	5 feet - 0 inches
	Control stations	3 feet - 10 inches
	Manual starters	5 feet - 0 inches
	Thermostats in office	3 feet - 10 inches
	Telephone/data outlets	1 foot - 6 inches
	Circuit protective devices	6 feet - 6 inches to top of enclosure

E. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of required access doors in accordance with other sections of the specifications.

F. Locate and install to maintain headroom and to present a neat appearance.

3.02 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide a minimum 6 in. separation in common wall cavity, except provide minimum 24 in. separation in acoustic rated walls. Refer to architectural drawings for locations of acoustic walls.

B. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

C. Provide knockout closures for unused openings.

D. Use multiple-gang boxes where multiple devices are shown to be installed together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

E. Install boxes in walls without damaging wall insulation.

F. Coordinate mounting heights and locations of outlets mounted above counters, benches and back splashes.

G. Position outlets to coordinate luminaire locations with ceilings.

H. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

I. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

J. Align wall-mounted outlet boxes for switches, thermostats and similar devices.

END OF SECTION 26 05 34

PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wireway systems as indicated in the Contract Requirements.

1.02 SUBMITTALS

A. Submit copies of manufacturer's specifications for products used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide wireway as manufactured by Square D, Hoffman, B-Line or accepted substitute.
B. General-purpose wireway: Square D Square Duct Series LD.
C. Wireway end closures, supports and associated fittings: Square D, of best forms and dimensions for applications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide systems of wireway of sufficient size where indicated. Provide for equipment racks or cabinets mounted in close proximity.
B. Size wireway cross-sectional area and length based upon conductor fill and equipment served as required by the NEC and local codes.
C. Install types based on environmental conditions to which exposed.
D. Coordinate the work in this section with the work under other divisions of this specification.

END OF SECTION 26 05 35

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PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of cable tray systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Submit copies of manufacturer's specifications for products used and 1/4-inch scale drawings of cable tray routing.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Chalfant Manufacturing Co.
B. Cooper B-Line.
C. Square D.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cable tray in accordance with manufacturer's instructions.
B. Provide support for cable tray at a distance not to exceed eight feet on center and at bends, T fittings and intersections.
C. Connect sections of cable tray together with edges free from burrs and sharp projections.
D. Coordinate the work with the work of other divisions of the specifications.
E. Install cable tray at elevations to maintain headroom and at locations to avoid interference with other work requiring grading of piping, the structure, finished ceiling, walls, access panels, etc.

END OF SECTION 26 05 36

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PART 1 GENERAL

1.01 WORK INCLUDED

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.
C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, and building control systems.

1.02 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically within 30 minutes when a room or area is vacated by the last person to occupy said room or area.
B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.
C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.03 SUBMITTALS

A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
C. Submit any interconnection diagrams per major subsystem showing proper wiring.
D. Submit standard catalog literature that includes performance specifications indicating compliance to the specification.

1.04 SYSTEM OPERATION

A. Factory Commissioning: It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system.

PART 2 SPECIFIC REQUIREMENTS

2.01 ACCEPTABLE MANUFACTURERS

A. The Watt Stopper.
B. Leviton.
C. Hubbell-My Tech-UNENCO.
D. Approved equivalent.

2.02 PRODUCTS

A. Leviton product numbers:
    1. Ceiling mounted dual technology (infrared & ultrasonic) sensors: OSC series, area coverage as required by application.
    2. Wall mounted dual technology (infrared & ultrasonic) sensors: OSSMT series.
    3. Wall mounted passive infrared sensors: ODS series.
    4. Power Packs: OSP20-RD0 series.
B. All sensors shall be capable of operating normally with any electronic ballast, PL lamp systems and rated motor loads.
C. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

D. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering. The maximum selectable time delay setting shall not exceed 30 minutes.
E. In the event of failure, a bypass manual 'override on' shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
F. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
G. All sensors shall provide a method of indication to verify that motion is being detected during testing and that the unit is working.
H. All sensors shall have no leakage current to load, in manual or in Auto/Off mode, for safety purposes during testing and shall have voltage drop protection.
I. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.03 CIRCUIT CONTROL HARDWARE - CU

A. Externally mount through a 1/2 in. knockout on a standard electrical enclosure or fixture housing and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer shall provide power to a minimum of two (2) sensors.
B. Relay Contacts shall have ratings of:
   1. 13A - 120 VAC Tungsten
   2. 20A - 120 VAC Ballast
   3. 20A - 277 VAC Ballast

2.04 CONTROL WIRING

A. Control wiring between sensors and controls units shall be Class II , 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable approved for use in plenums, where applicable.

PART 3 EXECUTION

3.01 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors if shown on the drawings are diagrammatic and indicate only the rooms to be provided with sensors. The contractor shall provide additional sensors as required to properly and completely cover the respective room.
B. Do not install sensors within 24 inches of HVAC system air devices.
C. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
D. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.02 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.
B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine-tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

END OF SECTION 26 09 24

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PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of miscellaneous items as described herein.

PART 2 PRODUCT

2.01 CONTACTORS AND RELAYS

A. As manufactured by ASCO, or accepted substitute, mechanically held with relays as required to operate on two wire control circuits.

2.02 TIMECLOCK

A. Tork DGLC, or accepted substitute.

2.03 PHOTOCELLS

A. Tork EPC1, or accepted substitute.

2.04 EXHAUST FAN TIMERS

A. Sixty minute: Paragon #FF51, or accepted substitute.

B. Fifteen minute: Paragon #FF15, or accepted substitute.

C. Label each timer, indicating which load it controls, with engraved laminated nameplate screwed on to front of cover.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's specifications and National Electrical Code and other governing authorities.

3.02 COORDINATION

A. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION 26 09 26

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PART 1 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for a complete and operational lighting control system as specified under this division and as shown on the Contract Drawings.

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

1.02 SYSTEM DESCRIPTION

A. Provide a lighting control system consisting of contactor control panel(s), control switches, photocell, and other controlling devices connected by low voltage wiring. The general operation of lighting and controlled loads shall include:

1. Interior lighting: manual switch control on/off for each space with automatic time scheduled shut-off.
2. Timed on/off loads: time on, time off.
3. Exterior lighting: photocell or astronomic on/time off, time on/photocell or astronomic off.
4. Exterior security lighting: photocell or astronomic on, photocell or astronomic off.

B. Requirements are indicated elsewhere in the specifications for work including, but not limited to, raceways and electrical boxes and fitting required for installation of control equipment and wiring.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Component Pre-testing: All components and assemblies are to be factory pre-tested prior to installation.

C. System Support: Factory applications engineers shall be available for telephone support.

D. UL Approvals: Remote panels are to be UL listed under UL 916 Energy Management Equipment.

E. FCC Emissions: All assemblies shall be in compliance with FCC emissions Standards specified in Part 15 Subpart J for Class A application.

1.04 SUBMITTALS

A. Shop Drawings: Submit dimensional drawings of all lighting control system components and accessories.

B. One Line Diagram: Submit a one-line diagram of the system configuration proposed if it differs from that illustrated in the riser diagram included in the contract drawings.

C. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, contactor panels, contactors, photocells, switches, occupancy sensors and daylighting controls.

1.05 MANUFACTURERS

A. The basis of the specified system is the Basic Control contactor panel manufactured by The Watt Stopper. Any other system wishing to be considered must submit descriptive information ten (10) days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the engineer.

PART 2 PRODUCTS

2.01 BASIC CONTROL CONTACTOR PANELS

A. Description

1. Basic Control contactor panels shall be UL listed and consist of the following:
   a. Tub: Empty NEMA 1 enclosure that can accept an interior sized to accept up to 16, 32, or 64 contactor poles.
   b. Cover: Surface or Flush as required, with captive screws in a hinged, lockable configuration.

c. Interior: Metal back plate and barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. Intelligence board with eight channels of control provided regardless of interior size, interiors shall be provided with up to 16, 32, or 64 DIN rail mounted contactor poles.

B. Features
1. Contactors shall be DIN rail mounted, four pole, normally closed, electrically held with coil voltage to match panel control power voltage. Contactors shall be compatible with all lighting, ballast and HID loads and be rated for 20 Amp tungsten up to 277V and rated for 30 Amp ballast and general use up to 600V. Provide 20% spare contactor poles.
2. Eight automatic control channels for operating contactors controlling exterior and/or interior lighting. Each channel shall be individually configurable to meet project needs. Each channel shall include an LED light status indicator to provide channel status and a separate ON/OFF/Auto switch for manual channel control.
3. Clock port for connection to the system clock. The system clock shall have eight override inputs to provide logic control of the eight channels from external photocells, switches, occupancy sensors, timers, daylighting controllers, etc.
4. Expansion terminals shall be provided for low voltage wiring connection between main and expansion panels in a multiple panel system. All automatic channel operation in the designated main panel (panel with the system clock), shall signal expansion panels' corresponding channels to operate.
5. Auxiliary power for operating optional system devices provides 350mA at 24VDC and 350mA at 24 VAC power.

2.02 SYSTEM CLOCK

A. Description
1. The system time clock shall be installed in the main or central panel of a multiple panel system or in each panel when individual panel time control is desired. The system clock shall provide time-based control with eight year time back-up, non-volatile memory program storage, automatic daylight savings adjustment, selectable 12/24 hour time formats and selectable date formats. All clock programming shall be accessible from the clock front display/keypad.

B. Features
1. Control of eight control channels shall be available on the clock. Provide status and manual ON/OFF control of each channel from the front display and keypad.
2. The clock shall have control of eight individual override inputs, which can be used to connect external devices such as photocells, switches and daylighting controllers. Each of these inputs can be configured to operate as a photocell, as an ON/Auto switch, as a maintained ON/OFF switch, or as a momentary ON/OFF switch.
3. Schedules shall be assigned to any combination of days of the week and/or 3 holiday day types. Other scheduling features shall include:
   a. Temporary schedules: Schedules that execute on an assigned day then automatically delete themselves from memory.
   b. Repeating schedules: Repeat a schedule at intervals that are adjustable from 5 minutes to 10 hours.
4. 32 perpetual holidays assigned to any one of three holiday day schedules and continuing for 1 to 120 days. Holiday dates shall be specific day/month/year, or perpetual dates including day/month/all years or day of the week in a given month every year or self-calculating Easter Sunday.
5. Astronomic capability for calculating sunrise and sunset based on time, latitude, longitude, and time zones. All scheduled astronomic/time operations shall be interlocked so loads are not turned on when astronomic off times are earlier than scheduled on times or astronomic on times are later than scheduled off times. Each schedule shall have an independent astronomic offset of ± 120 minutes.
6. Following a power outage, the system clock shall run a start-up process that executes schedules that would have been missed during the power outage.

2.03 AUTOMATIC CONTROL SWITCHES

A. Description

1. Automatic control switches shall be push button wall switches capable of ON/OFF manual operation and shall also be capable of receiving automatic control signals through interrupting power to the circuit feeding the switch and load. The automatic control switch shall mount in a standard single gang or multi-gang wall box and shall fit behind a decorator style faceplate.

B. Features
1. The automatic control switch shall use an air gap relay rated for 20 Amp ballast, tungsten, general use, and 1hp motor rating. It shall be compatible with all electronic ballasts and motor loads, and utilize self-adjusting zero cross switching technology.
2. Multiple operating modes/features selectable by using switch push button and configuration LEDs. Setting operating modes/features shall not require removal of switch faceplate. Switch settings shall include: occupancy sensor mode, audible beep, command ON feature.
3. Lighting control panel operation shall include the capability of automatically shutting switches off, turning switches on, and delaying switches off.
4. Delay OFF operation shall provide a one-two second warning blink followed by a five-minute delay time period before shutting off the lights. During the delay OFF period, the locator LED shall blink and, if enabled, an audible warning beep shall sound each minute for the first four minutes and each five seconds during the last minute of the delay time period. The delayed shut off may be canceled by pressing the front push button. After a lighting control panel OFF command, the locator LED light will illuminate.
5. Each switch shall operate in single, 3-way, 4-way or multi-way applications and provide full switch functionality from each switch location.

2.04 EXTERIOR PHOTOCELL

A. Description
1. The exterior photocell shall offer a footcandle range of 1-15 and an eight-second time delay. The photocell shall mount on the exterior or roof of a building with its light level window facing the northern sky. The photocell shall provide an ON signal when the ambient light level drops below a user-defined setpoint, and an OFF signal when the ambient light level rises above a user-defined light setpoint.

B. Features
1. The photocell shall use a set of normally open, isolated relay contacts that are rated for one Amp at 30 VAC/VDC.
2. The photocell shall have an adjustable ON/OFF dark setpoint.

PART 3 EXECUTION

3.01 INSTALLATION

A. Automatic control switches and/or photocells shall be mounted as indicated on the drawings. All wiring shall be labeled clearly indicating which contactor panel it connects to. Use only properly color-coded, stranded wire per manufacturer's recommendations. All channels and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the contactor schedule for each panel.

B. The contactor panels shall be mounted in electrical closets as indicated on the drawings. The contactors shall be wired to control the power of each load as indicated on the lighting control schedules included in the drawings. All power wiring will be identified with the circuit breaker number controlling the load. If multiple circuit breaker panels are feeding into a control panel, wires shall clearly indicate the originating panel's designation.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. Contractor shall provide system documentation after the equipment has been installed:
1. Lighting control panel schedule
2. Lighting channel schedule
3. System Clock schedule
4. System Installation and Operation Manual shipped with Basic Control contactor panel and System Clock shall be provided to the owner.

3.03 SYSTEM STARTUP

A. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all system components.

3.04 TRAINING

A. Manufacturer shall provide factory authorized application engineer to train owner personnel in the operation and programming of the lighting control system.

3.05 WARRANTY

A. Manufacturer shall provide a one year warranty for all system components.

END OF SECTION 26 09 27

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Refer to Section 26 28 16 - OVERCURRENT PROTECTIVE DEVICES.
C. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of panelboards as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturers' specifications for products used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Panelboards shall consist of a box, front, interior and circuit protective devices and shall be manufactured in accordance with NEMA standards and bear applicable UL labels.
B. The box shall be fabricated of code gauge galvanized sheet steel in accordance with UL standards, and shall have turned edges around the front for rigidity and for clamping on front. Provide standard knockouts on panel enclosure. Fabricate the front from sheet steel and finish with baked on gray enamel over a rust inhibitor. Each front shall have a door mounted on semi-concealed hinges with a cylinder lock, index card and cardholder. For dry indoor installation cover shall be door in door type (hinged door and continuous hinged cover). All panelboard locks shall be master keyed and all index cards shall be properly completed on a typewriter. Furnish two keys for each panelboard.
C. The interiors shall consist of a factory-assembled rigid frame supporting the rectangular bus, the mains and the neutral bar. The busing shall be arranged for sequence phasing throughout. Bus bar shall be sized to limit the temperature rise in accordance with NEMA standards. The insulated neutral bar shall be located at the opposite end of the structure from the mains. Panelboards shall have either solderless lugs or a main circuit protective device as scheduled. Each enclosure shall be provided with grounding lugs and uninsulated equipment grounding terminals.
D. Busing shall be tin plated aluminum attached for sequence phasing throughout.
E. Panelboards shall be three-phase, four-wire as scheduled or as required. Panelboards shall contain sequence style busing and full capacity neutral, composed of an assembly of bolt-in-place molded case automatic air circuit breakers with thermal and magnetic trip and trip free position separate from either "on" and "off" positions. Provide circuit breakers that simultaneously open all poles on double and three-pole circuit breakers. Provide panelboard and circuit breaker interrupting capacities and ratings equivalent to or greater than the fault current available to each panelboard and as shown on the Drawings. Series rating shall not be used in determining interrupting rating of panelboards. Single-pole circuit breakers serving fluorescent lighting loads shall carry the SWD marking. Circuit breakers serving high intensity discharge lighting loads shall carry the HID marking.
F. Where required by local or national code, ordinance or other authority, provide NEMA 3R enclosures where located in rooms with fire protection sprinklers. Further, if required by local or national code, ordinance or other authority, provide shields from sprinklers in working clearance in front of panelboards where panelboards are in rooms with fire protection sprinklers. Shields shall be constructed with same gauge metal as panelboard enclosure and shall have the same finish as panelboard enclosure.
G. Voltage rating, phase, number of wires and ampere rating shall be as shown and scheduled in the Contract Documents.
H. Approved manufacturers: Eaton (Cutler Hammer), General Electric (ABB), Siemens, or Square D.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install a panelboard at each location shown on the Drawings.

B. Each panel shall have a circuit index located on the inside of the cabinet door. This index shall have each circuit identified, including spares and spaces. The identification index shall be typewritten and covered with a plastic cover.

C. The various branch circuits served from the panelboards vary in loading. Carefully balance the load on each phase when connecting the various branch circuits in each panelboard. When all load is turned on and the system is operating a 100 percent demand, the initial unbalance shall not exceed 10 percent.

D. Refer to Section 26 27 16 regarding spare conduit requirements at flush-mounted panelboard cabinets and additional cabinet requirements.

E. Refer to Section 26 05 10 regarding labeling requirements for panelboards.

F. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION 26 24 16

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section .
B. Refer to Section 26 28 16 - OVERCURRENT PROTECTIVE DEVICES.
C. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of distribution panelboards as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Distribution panels shall be listed by Underwriters Laboratories and shall bear the UL label.
B. Each panelboard, as a complete unit, shall have a short circuit current rating equivalent to or greater than the fault current available to each panel. This rating shall be established by testing with the over current devices installed in the panelboard. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
C. Busing shall be tin plated aluminum.
D. Where required by local or national code, ordinance or other authority, provide NEMA 3R enclosures where located in rooms with fire protection sprinklers. Further, if required by local or national code, ordinance or other authority, provide shields from sprinklers in working clearance in front of panelboards where panelboards are in rooms with fire protection sprinklers. Shields shall be constructed with same gauge metal as panelboard enclosure and shall have the same finish as panelboard enclosure.
E. Provide ground fault protection on each main device, rated 480/277 ground wye, 1000 amps or larger, as follows:
    1. UL listed ground sensor relay system equivalent to ABB type GKT. Provide ground break components for each system with coordinated ground sensor and integral test winding. Provide with solid-state relay to operate shunt trip circuit on the switch and monitor panel.
    2. Use time delay type relay with the following features:
        a. Continuously adjustable current pick-up settings of 100 to 1200 amperes.
        b. Continuously adjustable time delay setting from instantaneous (.03 seconds) to one second.
        c. Memory function to recognize and initiate tripping on intermittent ground faults.
    3. Install panel which:
        a. Indicates relay operation
        b. Provides means for testing the system with or without interruption of electrical service.
        c. Does not permit the ground fault system to be inadvertently left in an inactive or ‘off’ state.
    4. Use ground sensor for zero sequence arrangement on the main service entrance devices.
F. Provide an arc energy reduction means for all overcurrent protective devices where the highest continuous trip current setting is rated at or can be adjusted to 1200 amperes or higher. The arc energy reduction shall be achieved by energy-reducing maintenance switching with local status indicator unless an alternate means is shown on the drawings.
G. Approved manufacturers: Eaton (Cutler Hammer), General Electric (ABB), Siemens, or Square D.

2.02 FUSIBLE DISTRIBUTION PANELS

A. All fusible branch switches shall be quick-make, quick-break with visible blades and dual horsepower ratings. Switch handles shall physically indicate “ON” and “OFF” positions. Switches shall be lockable only in the “OFF” position and accept three industrial type heavy-duty padlocks. Switch covers and handles shall be interlocked to prevent opening in the “ON” position. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes.

B. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutters shall be sized in accordance with UL Standard 67. Cabinets shall be equipped with a four-piece front without door and have concealed, self-adjusting trim clamps. Fronts shall be full finished steel with rust-inhibiting primer and baked enamel finish.

2.03 CIRCUIT BREAKER DISTRIBUTION PANELBOARDS

A. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.

B. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48 in. long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Fronts shall be of code gauge steel. Finish cabinet with gray baked enamel electrodeposited over cleaned phosphatized steel.

C. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

2.04 INTERRUPTING CAPACITY

A. Provide panelboard and over current interrupting capacities and ratings equivalent to or greater than the fault current available to each panelboard. Series rating shall not be used for determining interrupting rating of panelboards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install distribution panels in accordance with applicable codes.

B. Refer to Section 26 05 10 regarding labeling requirements for both the panel and its respective branch circuit feeders.

C. Coordinate the work under this section with the work under other divisions of the specifications.

3.02 TESTING

A. Performance test the arc energy reduction protection system by primary current injection testing or another approved method. This test shall be conducted by a qualified person(s) in accordance with manufacturer's instructions. Provide a written record of the testing to the Owner and to the authority having jurisdiction.

END OF SECTION 26 24 17

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Equipment for docking a generator and connecting to an electrical load, transfer switch or distribution equipment.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of Generator Docking Station indicated, include English dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, enclosure types, and finishes.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.
B. Field quality-control reports.
   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.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
   1. Manufacturer's written instructions for maintaining Generator Docking Station.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. UL (Underwriters Laboratories, Inc.) Standards
D. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2010 m).
B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Indicate method of providing temporary electric service.
   2. Do not proceed with interruption of electric service without Owner’s written permission.
   3. Comply with NFPA 70E.

1.08 COORDINATION

A. Coordinate layout and installation of Generator Docking Station, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 GUARANTEE/WARRANTY

A. The equipment installed under this contract shall be left in proper working order. Replace, without additional charge, new work or material which develops defects from ordinary use within one year unless a longer period is specified elsewhere, from substantial completion
B. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished.

PART 2 PRODUCTS

2.01 GENERATOR DOCKING STATION

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. TRYSTAR Product Family: Dual Purpose Generator Docking Station, As noted on the drawings. TRYSTAR Representative: Jeff Naumann jnaumann@vanjen.net 832-244-3332.
   2. Engineer's Approved Equal – No UL 508 or 891 Listings Acceptable. UL 1008 Required.

2.02 GENERAL REQUIREMENTS

A. Enclosures:
   1. Pad Mounted.
   2. Top, side, bottom, & back accessible for conduit cabling.
   3. Front & side accessible for maintenance.
   4. Rated for environmental conditions at installed location:
      a. Outdoor Locations: NEMA 250, Type 3R
   5. 3 Point Latching Handle for Front Door, Must be Padlockable
   6. All Aluminum – No Painted Steel Acceptable.
   7. Front Cover:
      a. Hinged.
      b. Gasketed.
      c. Pad-lockable latch
   8. Finishes:
      a. Powder Coat Only.
      b. Hammer Gray ANSI 61.

B. Phase, Neutral, and Ground Buses:
   1. Material: Silver-plated hard-drawn copper
   2. Ground Bus: 25% of phase size.
   3. Round edges on bus.

C. Bus Connectors:
   1. Located behind access plate inside front cover.
   2. Lugs

D. Outputs Connectors:
   1. Located inside front cover.
   2. 16 Series Camlock w/ Bus Bar Style Connections no Cabling is Acceptable.
   3. All Camlocks must have Protective Flip Covers.

E. Inputs Connectors:
   1. Located inside front cover.
   2. 16 Series Camlock w/ Bus Bar Style Connections no Cabling is Acceptable.
   3. All Camlocks must have Protective Flip Covers.
   4. Permanent Generator Connection Must Have Mechanical Lugs

F. Hinged cable access door on bottom of unit.

G. Padlockable front access cable trap door to reduce cable theft.

H. Accessories
   1. A – 2 Wire Auto Start (Contractor to Daisy Chain to Gen / ATS Start Signal)
   2. C - 20A 120VAC GFCI (Contractor to Pull from External LV Panelboard)
   3. D – 30A 120VAC L5-30 Receptacle (Contractor to Pull from External LV Panelboard)
   4. K – 1 Kirk Key Lock in cabinet, 1 Lock to Ship Loose, 1 Key
   5. Q – ML2-PB Load Dump Receptacle (Contractor to Pull from NC in Normal ATS Position Contact)
   6. Vendor Must Supply Load Dump Cable

I. Short Circuit and Withstand Rating
   1. Must be Factory Rated at 22KAIC SCCR

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Base Mounted: Install Generator Docking Station on concrete bases, 4-inch (100-mm) nominal thickness.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
   2. For Generator Docking Station, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting, drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
B. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: A qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. Acceptance Testing Preparation:
   1. Test insulation resistance for each Generator Docking Station, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
D. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each Generator Docking Station. Remove front panels so joints and connections are accessible to portable scanner.
   4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
E. Prepare test and inspection reports, including a certified report that identifies Generator Docking Station and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 25 51

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PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of cabinets as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Interior: Provide galvanized code gauge steel cabinets with over-lapped-welded corners with front edges turned over to receive trim. Provide adjustable trim fastened to the cabinets with captive hardware, continuous hinge doors, and a circuit directory on inside of door. The door shall have cylinder tumbler type lock. Provide combination three-point catch and lock for doors more than 48 in. high.

B. Exterior:

1. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2. Doors shall be gasketed and equipped with a tumbler type vault lock and two additional quarter turn fasteners on enclosures 59 inches (1499 mm) or more in height. Lock assemblies shall be keyed alike. One key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
3. Maximum enclosure dimensions shall not exceed 21 inches (533 mm) wide and 6.5 inches (165 mm) deep.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide cabinets for flush or surface mounting for all lighting panels, power panels and elsewhere as indicated.

B. Verify wall thickness prior to installation of flush-mounted cabinets to determine adequate space for cabinet to be flush mounted. If wall is not deep enough to install cabinet flush with wall, consult Architect for direction.

C. Install three one-inch empty conduits from each flush-mounted cabinet to nearest accessible ceiling space for future use. Turn conduits horizontal at accessible ceiling space.

D. If crawl space is located under cabinet, install three 1 in. conduits from each flush mounted cabinet to crawl space.

E. Coordinate the work under this section with the work of other divisions of this specification.

END OF SECTION 26 27 16

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.
B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wiring devices as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used. Manufacturer's catalog numbers listed are used to set the standard.
B. Acceptable Manufacturers: Hubbell, Leviton and Pass & Seymour. All wiring devices for the project shall be of one manufacturer.

PART 2 PRODUCTS

2.01 SWITCHES

A. Single pole, 20 amp
   1. Hubbell HBL1221; Leviton 1221-2; Pass & Seymour PS20AC1
B. Double pole, 20 amp
   1. Hubbell HBL1222; Leviton 1222-2; Pass & Seymour PS20AC2
C. Three way, 20 amp
   1. Hubbell HBL1223; Leviton 1223-2; Pass & Seymour PS20AC3
D. Key switches - Hubbell 1221RKL; Leviton 1221-2KL; Pass & Seymour PS20AC1KL series, with two keys. Prong keys will not be acceptable.
E. Provide 20 amp switches for loads exceeding 10 amps.
F. Use HP rated switches approved for motor control or disconnect service when controlling or disconnecting motor loads in excess of 1/4 HP.
G. Door switch on when door is open, equivalent to Pass & Seymour 1200.
H. Door switch on when door is closed, equivalent to Pass & Seymour 1201.
I. Switch with pilot light, equivalent to Hubbell 1221PL with red polycarbonate toggle.

2.02 WALL BOX PRESET DIMMERS

A. Provide Leviton “Renoir II” Series dimmers with linear slide and on/off switch or equivalent, sized for 150 percent of the load, unless larger size is indicated. Provide LED, incandescent, fluorescent, or low voltage type dimmer to match the load application shown on the drawings. Provide single-pole or three-way dimmers as indicated on plans. Provide gang dimmers as required in accordance with manufacturer's directions. Provide dimmers with white plastic coverplate.

2.03 RECEPTACLES

A. Simplex receptacle, 20 amp
   1. Hubbell HBL5361; Leviton 5361; Pass & Seymour 5361
B. Duplex receptacle, 20 amp
   1. Hubbell HBL5362; Leviton 5362; Pass & Seymour PS5362
C. Duplex receptacle, 20 amp, with split circuit hot tab and one controlled face permanently marked for use with automatic outlet control systems
   1. Hubbell BR20C1; Leviton 5362-1P; Pass & Seymour 5362CH
D. Duplex receptacle, 20 amp, with 2 Type A, 3 amp, USB jacks
   1. Hubbell USB8300; Leviton T5832; Pass & Seymour TR5362USB
E. Duplex receptacle, 20 amp, with 2 Type C, 5 amp, USB jacks
   1. Hubbell USB20C5 or equivalent
F. Safety or tamperproof receptacle, 20 amp
   1. Hubbell HBL5362TR; Leviton 5362-SG; Pass & Seymour TR63
G. Isolated ground receptacles, 20 amp
   1. Hubbell IG5362; Leviton IG5362; Pass & Seymour IG5362
H. Arc fault interrupting / tamper resistant receptacles, 20 amp
   1. Hubbell AFR20TR; Leviton AFTR2; Pass & Seymour AF202TR
I. Arc fault interrupting / tamper resistant / ground fault interrupting receptacles, 15 amp

1. Hubbell AFGF15TR; Leviton AGTR1; Pass & seymour AFGF152TR

J. Arc fault interrupting / tamper resistant / ground fault interrupting receptacles, 20 amp
   1. Hubbell AFGF20TR; Leviton AGTR2; Pass & Seymour AFGF202TR

K. Ground fault circuit interrupting (GFCI), tamper resistant, type receptacle, equivalent to Hubbell GFST83W. Provide weather resistant GFCI receptacle for exterior locations. Do not use feed-through feature. Install GFCI device at each location.

L. Transient Voltage Surge Suppressor (TVSS) receptacles shall be Hubbell IG5262S, blue duplex receptacle, or equivalent, UL 1449 listed for both Category A and B tests. Receptacle shall provide a minimum of 210 joules surge protection in all three modes: hot to neutral, hot to ground and neutral to ground.

M. Patient Care Areas:
   1. Duplex receptacle, 15 amp equivalent to Hubbell HBL8200
   2. Duplex receptacle, 20 amp equivalent to Hubbell HBL8300
   3. GFCI receptacle, 20 amp equivalent to Hubbell GFR8300TR

N. Use 20-amp receptacle when only one receptacle is on a circuit by itself, or as otherwise noted.

2.04 WIRING DEVICES

A. All wiring devices shall be white unless otherwise noted. Provide ivory wiring devices for normal power circuits. Provide red wiring devices for emergency power circuits.

2.05 COVERPLATES

A. Interior - smooth nylon equivalent to inch thick, color as selected by the Architect. Color may vary from room to room. Screw heads shall have color to match plate.

B. Provide telephone and data coverplates same as above, except with single bushed hole for cable. Leviton Quick-Port Wall plate insert with Quick-Port Snap-In Modules.

C. Exterior - extra heavy duty, die cast aluminum, weatherproof while-in-use cover equivalent to Hubbell WP26E series.

PART 3 EXECUTION

3.01 COORDINATION

A. Determine from dimensions shown in the Contract Documents and by actual measurements on the site the exact location of each wiring device. The wiring device locations shall be modified from those shown on the plans to accommodate changes in door swings, space changes or to clear other interferences that arise, or from other job modifications. Make such modifications at no cost to the Owner as a matter of job coordination. Notify the Architect of discrepancies before proceeding with the installation of the work.

3.02 TAMPER RESISTANT RECEPTACLES

A. All 125 volt, 15 and 20 ampere receptacles shall be tamper resistance type where shown on the drawings and as required by NEC Article 406.12.

3.03 INSTALLATION OF WIRING DEVICES

A. Install receptacles and switches only in electrical boxes that are clean, free from excess building materials, debris, etc.

B. Switches installed at one location shall be ganged together under one coverplate.

C. Install receptacles for electric water coolers out of sight where possible.

3.04 TESTING

A. Test wiring devices to insure electrical continuity of grounding then energize circuit to demonstrate compliance with requirements.

END OF SECTION 26 27 26

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment appliances required in conjunction with installation of overcurrent protective devices as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 FUSES

A. Fuses shall be current-limiting, with 200,000 RMS symmetrical amperes interrupting rating and shall be UL listed. All fuses shall be of same manufacturer.

B. Fuses over 600 amperes shall be Class L, bolt-on type, with time-delay and hold 500 percent rated fuse current for minimum of 4 seconds and clear 20 times rated fuse current in .01 seconds or less. Fuses shall have 'O' ring seals between end bells and glass melamine barrel, equivalent to Bussmann time delay KRP-C.

C. Fuses 600 amperes and smaller shall be Class RK1, dual element. These fuses shall have separated overload and short-circuit elements. The overload, time-delay element shall be spring activated and utilize a eutectic alloy with a 284-degree F. melting point. The fuse shall hold 500 percent of its rated fuse current for a minimum of 10 seconds, equivalent to Bussmann dual-element LPN-RK (250 volts or less rating) and LPS-RK (600 volts or less rating).

D. Fuses in motor circuits shall be changed, if necessary, as follows: Fuses for not less than 1.15 service factor motors shall have an ampere rating 125 percent of motor full load current or next higher fuse rating. Fuses for 1.0 service factor motors shall have an ampere rating 115 percent of motor full load current or next higher fuse rating. Use special fusing sizing considerations where motors are subjected to high ambient temperatures, where the motor drives an inertia load causing starting current to be prolonged, where on-off cycles less than 30 minutes, or where special hermetically sealed motors have unusual starting characteristics. When a physically smaller fuse is required in a switch, then the fuse clips must be changed.

E. Ballast controlled light fixtures shall have fuses installed on the line side of the ballast when indicated. The fixture manufacturer shall size fuses, Bussman GLR fuses and HLR fuse holder or equivalent for indoor installation.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. Molded Case Circuit Breaker Characteristics – General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
3. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
5. Circuit breakers shall be equipped with UL Listed electrical accessories as noted in these specifications. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position.
6. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.

7. Circuit breakers shall be equipped with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs (except Square D type Q2, Q2H and Q2-H or equivalent). Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors . Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating in the National Electrical Code. Provide lugs as required to accept feeder conductor sizes and quantities as shown on drawings.
8. All circuit breakers shall be capable of accepting bus connections.

B. Thermal-Magnetic Circuit Breakers
1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true RMS sensing and thermally responsive to protect circuit conductor(s) in a 40°C ambient temperature.
3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker except type Square D, Q2, Q2H and Q2-H or equivalent.
4. Standard two- and three-pole circuit breakers up to 250 amperes at 600 VAC shall be UL Listed as HACR type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install overcurrent devices in accordance with the National Electrical Code. Coordinate the work under this section with the work under other divisions of the specifications.
B. Do not share neutral conductors between circuits protected by arc fault circuit interrupters.
C. Fuses shall be installed in all switches as scheduled or noted on the Drawings, and shall be Bussman, Mersen, Littelfuse, Inc., or an approved equivalent.
D. Unless otherwise indicated, protective devices shall be mounted with top of cabinet or enclosure 6 ft. 6 in. above finished floor, properly aligned, and adequately supported independently of the connecting raceways. All steel shapes, etc., necessary for the support of the equipment shall be furnished and installed where the building structure is not suitable for mounting the equipment directly thereon.

END OF SECTION 26 28 16

PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with installation of disconnect switches as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish fusible Class 'R' or non-fusible disconnect switches of ampere rating as required, or as indicated on the Drawings. Furnish heavy-duty, quick-make, quick-break, three-phase, three-pole switches, unless otherwise noted. Use NEMA 1 enclosures where installed indoors. Use NEMA 3R for outdoor enclosures. Provide enclosures with interlocking covers, externally front operated flange mounted switch levers, and provisions for use of three safety padlocks in the 'Off' position. Provide horsepower rated switches for motor circuits.

B. Approved manufacturers: Eaton (Cutler Hammer), General Electric (ABB), Siemens, or Square D.

PART 3 EXECUTION

3.01 INSTALLATION

A. See Section 26 05 10 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK paragraph: Identification of Electrical Equipment.

B. Install switches to comply with National Electrical Code and coordinate the work with the work under other divisions of the specifications.

END OF SECTION 26 28 17

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes packaged engine-generator sets suitable for use in mission critical applications with the features as specified and indicated. Engine generators will be used as the Standby power source for the system but shall be capable of providing reliable power with no run-time limitations while the primary source of power is unavailable.

C. DEFINITIONS

1. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.
2. Prime Power (PRP): Per ISO 8528: The maximum power which a generating set is capable of delivering continuously whilst supplying a variable electrical load when operated for an unlimited number of hours per year under the agreed operating conditions with the maintenance intervals and procedures being carried out as a prescribed by the manufacturer. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the PRP unless otherwise agreed by the RIC engine manufacturer.
3. Limited Time running Power (LTP): Per ISO 8528: The maximum power available, under the agreed operating conditions, for which the generating set is capable of delivering for up to 500 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers.
4. Continuous Operating Power (COP): Per ISO 8528: The maximum power which a generating set is capable of delivering continuously whilst supplying a constant electrical load when operated for an unlimited number of hours per year under the agreed operating conditions with the maintenance intervals and procedures being carried out as a prescribed by the manufacturer.
5. Data Center Continuous (DCC): The maximum power which a generating set is capable of delivering continuously whilst supplying a variable or constant electrical load when operated for an unlimited number of hours in a data center application under the agreed operating conditions with the maintenance intervals and procedures being carried out as a prescribed by the manufacturer. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 100 percent of the DCC rating.
6. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

D. ACTION SUBMITTALS

1. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
   a. Thermal damage curve for generator.
   b. Time-current characteristic curves for generator protective device.
   c. Sound test data, based on a free field requirement.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.
   a. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
   b. Wiring Diagrams: Control interconnection, Customer connections.

3. Certifications:
    a. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.

E. INFORMATIONAL SUBMITTALS
1. Source quality-control test reports.
    a. Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.
    b. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.
    c. List of factory tests to be performed on units to be shipped for this Project.
    d. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.
2. Warranty:
    a. Submit manufacturer’s warranty statement to be provided for this Project.

F. QUALITY ASSURANCE
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
3. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
4. Comply with NFPA 37 (Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines).
5. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).
6. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.
7. Comply with UL 2200.

G. PROJECT CONDITIONS
1. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
    a. Ambient Temperature: 0.0 deg C (32.0 deg F) to 40.0 deg C (104.0 deg F).
    b. Relative Humidity: 0 to 95 percent.
    c. Altitude: Sea level

H. WARRANTY
1. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product and twelve (12) months for Prime/Continuous product from registered commissioning and start-up.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: The basis for this specification is Cummins Power Generation equipment, approved equals may be considered if equipment performance is shown to meet the requirements herein.

2.02 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.
B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

C. Capacities and Characteristics:
   1. Power Output Ratings: Electrical output power rating for Standby operation of not less than 250.0 kW, at 80 percent lagging power factor, Series Wye, Three phase, 4 -wire, 60 hertz.
   2. Alternator:
      a. Steady state kVA rating shall be 300 kVA with a maximum temperature rise of 80/105/125 C based on specified maximum site ambient conditions. Provide derating calculations for all applications with ambient temperature greater than 40C (104F) and site altitude great than 305M (1000ft) based on alternator manufacturer's published documentation.
      b. The alternator shall accept a full load step at rated kVA with a maximum voltage dip of 10 (medical imaging)/15 (fire pump)/20/30 percent based on the transient reactance of the alternator proposed. Provide documentation (with calculations if necessary) demonstrating compliance to this requirement.
      c. Alternator provided shall provide a minimum recovery voltage kVA of three times the alternator rated kVA per the requirements of NEMA MG1 Part 32 section 18.2.2. "Motor starting kVA" based on any other practice is not acceptable and will result in rejection of the proposed alternator.
      d. Provide published documentation of performance or a test procedure, compliant to the requirements of NEMA MG1 part 32, for a factory test that will be performed documenting required performance.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.

D. Generator-Set Performance:
   1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
   2. The generator set shall pick up a block load equal to the specified kW at 0.8 power factor at rated site conditions and recover to rated voltage and frequency.
   3. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.
   4. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor. Additionally, the maximum generator voltage dip on application of the largest single load step, 155 kW, 239 kVA, considering both alternator performance and engine speed changes, shall not exceed 30%.
   5. Steady-State Frequency Operational Bandwidth: 0.25 percent of rated frequency from no load to full load.
   6. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
   7. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.
   8. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
   9. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.

10. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.
11. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.03 ENGINE

A. Fuel: ASTM D975 #2 Diesel Fuel
B. Rated Engine Speed: 1800RPM.
C. Lubrication System: The following items are mounted on engine or skid:
   1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
   2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
   3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions
E. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.
   1. Designed for operation on a single 120 VAC, Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.
   2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.
   3. Provided with a 24VDC thermostat, installed at the engine thermostat housing
G. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.
H. Cooling System: Closed loop, liquid cooled
   1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40 deg C.
   2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
   4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
   5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
   6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.
I. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.
J. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.
K. Starting System: 12 or 24V, as recommended by the engine manufacturer; electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Cycle: As required by NFPA 110 for level 1 systems.
3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:
   a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.
   f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.04 FUEL OIL STORAGE

A. Comply with NFPA 30.
B. UL 142 listed, sub-base fuel tank with the following features:
   1. Minimum 125% secondary containment capacity.
   2. Emergency pressure relief vent terminated a minimum of 12 feet above the bottom of the tank.
   3. Normal atmospheric vent terminated a minimum of 12 feet above the bottom of the tank.
   4. Raised fuel fill with lockable sealed cap.
   5. Lifting eyes to allow lifting of fuel tank with generator set installed.
   6. Secondary containment basin switch to activate a warning in the event of a primary tank leak.
   7. Low fuel level switch to activate a warning when 40% of the fuel is left in the tank.
   8. Electric fuel level sender with gauge to allow remote electrical monitoring of the fuel tank level.
   9. Spill containment box for fuel fill, five gallon capacity with integral drain to tank and lockable cap.
   10. Overfill prevention valve to shut off fuel flow during filling at approximately 95% full including fill down tube terminating within 6 inches of the fuel tank bottom.
   11. High fuel switch to activate at 90% of full fuel level.
   12. High fuel alarm panel to provide audible and visual alarm when fuel level reaches 90% of full fuel level.

2.05 CONTROL AND MONITORING

A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
   1. AC voltmeter (3-phase, line to line and line to neutral values).
   2. AC ammeter (3-phases).
   3. AC frequency meter.
   4. AC kW output (total and for each phase). Display shall indicate power flow direction.
   5. AC kVA output (total and for each phase). Display shall indicate power flow direction.
   6. AC Power factor (total and for each phase). Display shall indicate leading or lagging condition.
   7. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
   8. Emergency Stop Switch: Switch shall be a red “mushroom head” pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
   9. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
   10. DC voltmeter (alternator battery charging).
   11. Engine-coolant temperature gauge.
   12. Engine lubricating-oil pressure gauge.
   13. Running-time meter.
   14. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.) The voltage and frequency adjustment functions shall be disabled when the paralleling breaker is closed.
   15. Fuel tank derangement alarm.
   16. Fuel tank high-level shutdown of fuel supply alarm.
   17. AC Protective Equipment: The control system shall include over/under voltage, reverse kVAR, reverse kW, over load (kW) short circuit, over current, loss of voltage reference, and over excitation shut down protection. There shall be a ground fault alarm for generator sets rated over 1000 amps, overload warning, and overcurrent warning alarm.
   18. Status LED indicating lamps to indicate remote start signal present at the control, existing shutdown condition, existing alarm condition, not in auto, and generator set running.
   19. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

20. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.
21. Data Logging: The control system shall log the latest 20 different alarm and shut down conditions, the total number of times each alarm or shutdown has occurred, and the date and time the latest of these shutdown and fault conditions occurred.
22. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).

F. Control Heater: Generator sets that are installed in outdoor enclosures, or are in tropical or coastal environments shall be provided with control heaters for anti-condensation protection.
G. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition.
H. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.06 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:
    1. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
    2. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is in excess of 110% of rated current for more than 10 seconds.
    3. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.
    4. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.
    5. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.
    6. The protective system provided shall not include an instantaneous trip function.

2.07 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.
B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
C. Electrical Insulation: Class H
D. Temperature Rise: 150 / Class H, Standby environment.
E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
F. Enclosure: Drip-proof.
G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, 3-phase true RMS sensing, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.
H. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
I. Subtransient Reactance: 12 percent maximum, based on the rating of the engine generator set.

2.08 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Weather Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:
   1. Louvers: Equipped with bird screen to permit air circulation when engine is not running while excluding birds and rodents.
   2. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
   3. Exhaust System:
      a. Muffler Location: Within enclosure.
   4. Hardware: All hardware and hinges shall be stainless steel.
   5. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.
   6. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
   7. Inlet ducts shall include rain hoods

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.
   1. Louvers: Fixed-engine, cooling-air inlet and discharge.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 75 dBA measured at any location 7 m from the engine generator in a free field environment.

E. Site Provisions:
   1. Lifting: Complete assembly of engine generator, enclosure, and sub base fuel tank (when used) shall be designed to be lifted into place as a single unit, using spreader bars.

2.09 VIBRATION ISOLATION DEVICES

A. Vibration Isolation: Generators installed on grade shall be provided with elastomeric isolator pads integral to the generator, unless the engine manufacturer requires use of spring isolation.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer’s standard color or as directed on the drawings.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
   1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.
   2. Full load run.
   3. Maximum power.
   4. Voltage regulation.
   5. Steady-state governing.
   6. Single-step load pickup.
   7. Simulated safety shutdowns.
   8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
   9. Additional testing requirements may be added to this section

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.

B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.
F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

3.02 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:
B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.
C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.03 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.04 FIELD QUALITY CONTROL

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

3.05 SERVICE AND SUPPORT

A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The inventory shall have a commercial value of $3 million or more. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.
B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 100 miles of the site.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

END OF SECTION 26 32 13

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of automatic transfer switches as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide Onan, or accepted substitute, automatic transfer switches with control panel of ratings indicated and required for use on systems indicated. Provide remote display and control panel.

B. Provide neutral overlap or four-pole switches if ground fault systems are present on the job site or where the transfer switches serve two separately derived systems.

C. Transfer switches supplied for this project shall have a minimum withstand and closing ratings equivalent to or greater than the fault current available to the transfer switch. These ratings shall be the ratings listed in the UL listing for the transfer switches supplied.

D. Ratings:

1. Transfer switches shall be UL listed per Standard 1008. Transfer switches supplied shall be suitable for use on emergency and legally required standby systems in accordance with ANSI-C1 and NFPA 76A, rated for total system load (including motor loads, electric discharge lamps, restrictive loads, and tungsten lamp loads as described in Section 1 of UL Standard 1008).
2. Transfer switches shall be 60 Hz, with solid neutral. Refer to drawings for quantities and locations of switches, number of phases, number of poles, voltages, and ampere ratings.
3. Transfer switches shall be rated to carry 100 percent of their rated current continuously in the enclosure.
4. Transfer switches shall be rated for continuous operation in ambient temperatures of -40°C (-40°F) to +50°C (+122°F). Main power switch contacts shall be rated for 600 VAC minimum.

E. Construction:

1. Transfer switches shall be double-throw construction, positively electrically and mechanically interlocked by a simple mechanical beam to prevent simultaneous closing (for break before make operation), and mechanically held in both normal and emergency positions.
2. Transfer switches shall be quick-break, quick-make operation so that the operator does not control the speed of opening and closing during manual operation. Transfer switches shall provide a center "programmed transition" position for manual switching. Transfer switches shall be approved for manual operation under full load by integrally mounted, permanently attached, high-dielectric, manual-operating handles.
3. Transfer switches shall not contain any integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses. Transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching.
4. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door.
5. All switches shall have transparent protective covers to protect personnel during manual operation, and to allow operator to visually determine whether main contacts are "open" or "closed".
6. Main switch contacts shall be high-pressure silver alloy contacts to resist burning and pitting for long life operation. Switches shall have arc chutes of heat absorbing material and metal leaves for positive extinguishing of arcs quickly and effectively; arc chutes shall have insulating covers to prevent interphase flashover.

7. Transfer switches shall have one SPDT, 10-ampere auxiliary switch on both normal and emergency sides, operated by the transfer switch. These switches shall be factory wired to an easy access terminal block and shall be used to monitor transfer switch position for controlling indicator lights or other peripheral equipment. Provide additional auxiliary relays as required to provide proper functioning of system.
8. Provide AL-CU lugs, UL listed and approved, for normal, emergency, and load positions. Load connections shall be designed for field relocation, either from top to bottom or vice versa. Wiring space at normal, emergency, load, and neutral lugs inside the switch cabinets shall comply with NEC Table 373-6(b). Full rated neutral bar with lugs for normal, emergency, and load neutral conductors shall be provided inside cabinet.
9. Unless noted or specified otherwise, each transfer switch shall be installed in separate NEMA 1 cabinet with key-locking front door. Provide weatherproof enclosure if equipment is installed outdoors or in a wet location.

F. Controls:
1. Install control accessories in a separate smaller cabinet on inside of main cabinet door, to allow for ease of service access when main cabinet lockable door is opened, but to prevent access by unauthorized persons. Provide control disconnect plugs to de-energize control circuits and avoid shock hazard while making control adjustments. The solid-state voltage sensors and time delay modules shall be plug-in circuit boards with gold contacts for ease of service. The control relays shall also be plug-in type.
2. Solid-state undervoltage sensors shall simultaneously monitor all phases of the normal source and all phases (all 3-phases for 3-phase systems) of the emergency source to provide adjustable range sensors for field adjustment for specific application needs. Pick-up setting shall be adjustable from minimum of 85% to maximum of 100% of nominal voltage. Dropout settings shall be adjustable from minimum of 74% to maximum of 98% of pick-up setting with fixed dropout time delay of 0.5 seconds. Voltage sensors shall be temperature compensated type, for maximum deviation over the temperature range of -25°F to +175°F. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase or normal or emergency source, even where motor feedback voltages exist.
3. Controls shall signal the emergency power system to start upon signal from normal source voltage sensors. Adjustable solid-state time delay start shall avoid nuisance start-ups on momentary voltage dips or momentary interruptions.
4. Switch shall transfer the load to the emergency power system after the generator set reaches proper voltage and frequency. Adjustable solid-state time delay transfer shall allow the engine-generator set to stabilize before application of load.
5. The transfer switch shall control the generator set to allow generator set to start and transfer load within 10 seconds after normal source power failure.
6. Switch shall retransfer the load to the normal source after normal power restoration. Adjustable solid-state time delay retransfer shall allow normal power to stabilize before retransfer and shall allow staggered retransfer of loads in multiple transfer switch systems.
7. Controls shall signal the engine-generator set to stop after load retransfer to normal source. Adjustable solid-state time delay stop shall maintain availability of emergency source in event that normal source fails shortly after retransfer and shall permit engine to run unloaded for cool down before shut down.
8. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency source to normal source if emergency source fails when normal source is available.
9. Controls shall provide built-in "control mode status indicators", consisting of L.E.D.'s to indicate a sequence of functions such as the following:
    a. Source 1 OK
    b. 2-Wire Run
    c. Source 2 OK
    d. Timing for Transfer
    e. Transfer Command
    f. Timing for Retransfer

g. Retransfer Command
h. Timing for Stop

10. These indicators shall allow the operator to determine that the controls are properly sequencing and shall assist in determining sequence of any malfunctions that might occur.
11. Provide devices mounted on front of main cabinet door consisting of oil-tight, neon position indicator lamps (white - "NORMAL" and amber "EMERGENCY") and a key- operated selector switch to provide the following positions and functions:
    a. TEST - Simulated normal power loss to control unit for testing of generator set, including transfer of load. Control system shall provide for "system test without load transfer" for use in that manner when desired.
    b. NORMAL - this is normal operating position and it restores the load to the normal source after test and after time delays.
    c. RETRANSFER - Momentary position to override retransfer time delay and cause immediate return to normal source after test or actual outage.
12. Start contacts for 2-wire engine control shall be gold type, Form-C, dry contacts wired to easy access terminal block. Provide 2 to 3 wire converter where required for 3-wire engine control.
13. All transfer switches shall have the "programmed transition" feature available by plugging in the proper program timer into the factory installed time receptacle. This feature shall be available as being factory installed or for field installation. This feature shall provide a field adjustable time delay during switching in both directions, during which time the load is isolated from both power sources, to allow residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle. This device shall be connected in a manner that shall not cause the time delay in switching, where the time delay has already been established by loss of voltage to the load during normal source power interruptions.
14. In addition to auxiliary contacts for mechanical and other equipment coordination and interface, provide one additional normally open set of contacts on both normal and emergency relays.

2.02 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
    1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
    2. Switch position.
    3. Switch in test mode.
    4. Failure of communication link.
B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
    1. Indicating Lights: Grouped for each transfer switch monitored.
    2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
    3. Switch in test mode.
    4. Lamp Test: Push-to-test or lamp-test switch on front panel.
C. Malfunction of annunciator or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation.
D. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation. The remote annunciation system shall not prevent transfer to the alternate source when the primary power source fails, nor prevent return to the primary source if the alternate source fails
E. Accessory Items: When transfer switch serves an elevator(s), include the following accessory items:
    1. Provide elevator signal relay packages to give the elevator control system a 1 to 300 second, field adjustable, "NOX" pre-signal prior to transfer and retransfer. This allows an orderly elevator circuit shutdown. The package also provides an "EO" signal to elevator control system while transfer switch is in the "emergency" position.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install automatic transfer switches at locations indicated in the Contract Documents.
B. Install remote display and control panel where indicated in the Contract Documents.
C. Adjust mechanical operation devices and test electrical operation to assure switches function as intended.
D. Provide interfaces to other systems as required.
E. Coordinate the work under this section with work under other divisions of the specifications.
F. Clean and touch-up finishes with manufacturer's matching touch-up paint.
G. Supply operating and maintenance instruction manuals and explain these procedures to operating personnel.

END OF SECTION 26 36 23

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers.

1.02 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.03 SUBMITTALS

A. The following information shall be submitted:
   1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).
   2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

B. The following additional information shall be submitted:
   1. Descriptive bulletins.
   2. Product sheets.

1.04 RECORD DOCUMENTS

A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in Section 1.03 and shall incorporate all changes made during the manufacturing process.

1.05 QUALIFICATIONS

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton (Cutler Hammer)
B. General Electric (ABB)
C. Square D (APT)
D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 VOLTAGE SURGE SUPPRESSION - GENERAL

A. Electrical Requirements
   1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	500Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design
1. Maintenance Free Design - The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform - The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter - Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable to meet this specification shall not be accepted.
4. Internal Connections - No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics - Each SPD shall provide the following integral monitoring options:
   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
      1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
      2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

b. Remote Status Monitor - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

c. Audible Alarm and Silence Button - The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

d. Surge Counter - The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection

a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design - All of the SPDs components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.03 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity - The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI/IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MMC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

C. SPD Type - all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.04 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
   1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
   2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
   3. The panelboard shall be capable of re-energizing upon removal of the SPD.
   4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
   5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
   6. The SPD shall be of the same manufacturer as the panelboard.
   7. The complete panelboard including the SPD shall be UL67 listed.

B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
   1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

C. Switchgear, Switchboard, MCC and Busway Requirements
   1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
   2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
   3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
   4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
   5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.05 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
   1. NEMA 1 - Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
   2. NEMA 4 - Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)
   3. NEMA 4X - Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
D. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.03 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.04 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION 26 43 13

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PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - General Requirements for Electrical Work.
B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of a lighting system as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of fixture, ballast and lamp manufacturer's specifications for products used. Identify the total input watts including ballast losses for each fixture type.
B. Submit lighting facts documentation for all LED fixtures.
C. If required by Architect, submit samples of lighting fixtures for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lighting Fixtures: See Schedule in Contract Documents.
B. Plastic lens for fluorescent fixtures shall be virgin acrylic, minimum thickness of 0.125 inches.
C. Where fixtures are subject to moisture, provide damp location (DL) or wet location (WL) label on fixtures as required for the location.

2.02 BALLASTS

A. Unless otherwise specified in the Contract Documents, ballasts for fluorescent lamps shall be electronic, full light output, high power factor, rapid start, dual protected, Class P, for the number of lamps as specified with 10% THD, or less. Ballast factor shall be no less than 0.9. Provide ballasts manufactured in accordance with CBM standards, ETL certified, and UL approved, and sound rated 'A'. Provide ballasts protected by a built-in resetting thermal protector.
B. Provide cold weather ballasts in fixtures that are subject to temperatures below 40°F.
C. Ballasts for high intensity discharge lamps shall be high power factor, potted and encapsulated. Starting current shall not exceed running current.
D. Ballasts for metal halide lamps from 150 to 500 watts shall be pulse start with a minimum efficiency of 88 percent.
E. Fluorescent dimming ballasts shall be UL approved, Class P thermally protected, and provide a smooth and continuous without flicker to 5% light level for T-12, T-8 and T-5 lamps. Provide ballasts with ballast factor no less than 0.93, total harmonic distortion less than 10% and lamp current crest factor less than or equivalent to 1.6.
F. Provide ballasts of compatible design to lamps specified.

2.03 LAMPS

A. Fluorescent: 4100 K, rapid start, T-8, 32 watt unless noted or scheduled otherwise, with initial lumens at least 2850, Philips F32T8/TL741 or approved substitute.
B. Incandescent: Inside frosted, 130 volt, general service unless noted or scheduled otherwise.
C. Mercury vapor: Deluxe white phosphor coated, unless noted or scheduled otherwise. Use self-extinguishing type, which extinguish if outer lamp envelope is broken.
D. Metal halide: Phosphor coated, unless noted or scheduled otherwise. Use self-extinguishing type which self-extinguish if outer glass envelope is broken. Provide pulse start lamps from 150 to 500 watts.
E. High-pressure sodium: Color-improved diffuse-coated, for any burning position unless noted or scheduled otherwise.
F. Approved manufacturers: Philips, Sylvania and General Electric.

2.04 LED FIXTURES

A. Shall be tested for adherence to IESNA LM79 standards for lumen output and depreciation.
B. Shall be tested to IESNA LM80 standards and shall be rated to deliver LM80 performance for 50,000 hours.
C. Shall be DLC (DesignLight Consortium) certified.
D. Shall be equipped with 0-10 volt dimming driver.
E. Shall carry a 5 year all-inclusive component warranty for defects.

2.05 EXIT LIGHTS

A. Furnish and install exit lights as indicated in the Contract Documents.
B. Provide single or double face unit as required for each location with arrows as required to clearly define the path of egress, whether shown on the drawings or not. Provide battery powered exit lights, for ninety minute duration, if exit lights are not served with an emergency power source.
C. Locate fixtures on the ceiling or wall as required by the Architect.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide lighting fixtures as specified and scheduled in the Contract Documents. Provide in accordance with the type designation shown in the Contract Documents. If a type designation is omitted, verify fixture selection with Architect prior to installation.
B. Check the architectural finishes, and provide fixtures with proper trim, frames, supports hangers, and other hardware as required to coordinate with proper finishes, regardless of specified or scheduled catalog number, prefixes and suffixes.
C. Coordinate with Division 23 and other divisions of the specifications to avoid conflicts between lighting fixtures, supports and fittings and mechanical equipment and other work.
D. Fixtures, which are tandem mounted and recessed in gypboard or plaster ceilings shall be yoke mounted.
E. Immediately before final inspection, clean all fixtures, inside and out, including plastics and glassware, adjust all trim to properly fit adjacent surface, replace broken or damaged parts. Lamp and test all fixtures for electrical as well as mechanical operation.
F. Provide new lamps delivered to the job in the original packing cases and sleeves.
G. Test and aim floodlights, after dark, to provide a uniform and widespread illuminated area. Direct units as indicated or instructed by Architect. Direct units to prevent objectionable glare.

3.02 EXTERIOR LIGHTING CONTROL

A. Furnish a complete exterior lighting control system as indicated in the Contract Documents with additional work as required herein.
B. Provide material and equipment to properly interface timing devices and photocells with relays and contactors as required to render a complete and satisfactory operating system.

3.03 UL LISTED CEILING ASSEMBLIES

A. Provide special mounting, enclosures, and fire saving as required by authorities having jurisdiction to maintain integrity of UL listed ceiling assemblies where applicable.

END OF SECTION 26 51 13

PART 1 GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of empty conduit systems for telephone, computer communication and other systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

PART 2 PRODUCT

2.01 MATERIAL

A. Provide cabinets as specified elsewhere in the specifications. Furnish total metal unit with enclosure, hinged door, lock with two keys and installed with 3/4 in. thick plywood in back.

B. Provide 3/4 in. thick marine plywood painted with one coat of primer and two coats of latex enamel to match surroundings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide a 1 in. conduit from each telephone, data or combination telephone/data outlet to the accessible ceiling space above unless noted otherwise. Turn the conduit horizontal, provide a pull string in the conduit and a plastic bushing on the conduit end.

B. At each telephone board, install #6 copper ground wire from nearest ground bus to telephone board and leave 12 in. pigtail at telephone board.

C. Install pull wire in all empty conduits or conduit systems. Label pull wire indicating the location of the other end.

D. Quantity of bends and radius of each bend for telephone conduit system shall be in accordance with requirements as set forth by the telephone company.

E. Install junction and pull boxes in empty conduits for telephone system in accordance with telephone company requirements.

F. Coordinate the work in this section with the work under other divisions of the specifications.

END OF SECTION 27 05 28

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PART 1 GENERAL

1.01 SCOPE

A. This specification document provides the requirements for the installation, programming and configuration of a complete Silent Knight 6700 digital protocol analog addressable fire alarm system.

B. This system shall include, but not be limited to, system cabinet, power supply, built in Signaling Line Circuit (SLC), 80-character LCD annunciator, two programmable notification circuits, built in dual-line, IP and optional cellular digital communicator, associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational life safety system.

1. The 6700 has the interconnection capability for up to 17 fire alarm control panels (FACPs) with one panel acting as the communicator for panels in a link.

1.02 GENERAL REQUIREMENTS

A. The contractor shall furnish and install a complete 24 VDC, electrically supervised, addressable fire alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required to provide a complete operating fire alarm system.

1.03 LABELING

A. All fire alarm system equipment shall be listed for it's intended purpose and be compatibility listed to assure the integrity of the complete system.

1.04 STANDARDS

A. The fire alarm equipment and installation shall comply with the current provisions of the following standards and shall be listed for it's intended purpose and be compatibility listed to insure integrity of the complete system.

B. National Electric Code, NFPA 70Article 760

C. National Fire Protection Association Standards:

NFPA 13	Installation of Sprinkler Systems
NFPA 15	Water Spray Fixed Systems
NFPA 16	Deluge Foam Water Systems
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 720	Standard for the Installation of CO Detection

D. Local and State Building Codes

1. BOCA, National Building Code, Mechanical Code, Fire Prevention Code
2. Local Authorities Having Jurisdiction

E. Underwriters Laboratories Inc.

1. All equipment shall be approved by Underwriters Laboratories, Inc. for its intended purpose, listed as power limited by Underwriters Laboratories, Inc., for the following standards as applicable:

UL 864 UOJZ	Control units for Fire Protective Signaling Systems. Local Signaling Unit. Central Station Signaling Protected Premises Unit. Remote Signaling Protected Premises Unit.
UL 2075	CO Detectors Connected to FACP.
UL 864 SYZV	Releasing Device Control Unit (Water Release Only).
UL 268	Smoke Detectors for Fire Protective Signaling Systems.
UL 268A	Smoke Detectors for duct applications.
UL 217	Smoke Detectors for Single Stations.
UL 521	Heat Detectors for Fire Protective signaling systems.

UL 228	Door Holders for Fire Protective signaling systems.
UL 464	Audible signaling appliances.
UL 1638	Visual signaling appliances.
UL 38	Manually Activated Signaling Boxes.
UL 346	Waterflow indicators for Fire Protective signaling systems.
UL 1481	Power Supplies for Fire Protective Signaling systems.

F. Americans with Disabilities Act (ADA).
1. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act.

1.05 GENERAL REQUIREMENTS

A. Manufacturers/Distributors Services:
1. The following supervision shall be provided by a trained fire alarm system service technician. The technician's name shall appear on equipment submittals and sent to the project engineer. The technician shall be responsible for the following items:
a. A pre-installation visit to the job site to review equipment submittals and to verify the method by which the system is to be wired.
b. During installation the technician shall be on site or make periodic visits to verify installation and wiring of the system. S/he shall also supervise the completion of conduit rough, wires pulled into conduit and wiring rough, and ready for trim.
c. Upon completion of wiring, final checkout and certification of the system shall be made under the supervision of this technician.
d. At the time of the formal checkout, the technician shall give operational instructions to the owner and or their representative on the system

B. Submittals
1. The contractor shall submit three (3) complete sets of documentation within thirty (30) calendar days after award of the purchase order. Indicated in the document will be the type, size, rating, style, catalog number, manufacturer names, photos, and /or catalog data sheets for all items proposed to meet these specifications. The proposed equipment shall be subject to the approval of the Architect/Engineer and no equipment shall be ordered or installed on the premises without that approval.
2. NOTE: DOCUMENTATION - Submittal of shop drawings shall contain at least three (3) copies of the manufacturer specification and installation instruction sheets. All equipment and devices on the shop drawings to be furnished under this contract shall be clearly marked in the specification sheets.
3. Supplier qualifications shall be submitted indicating years in business, service policies, warranty definitions, NICET certification or equivalent where required, completion of a factory training program and a list of similar installations.
4. Contractor qualifications shall be supplied indicating years in business and prior experience with installations that include the type of equipment that is to be supplied.
5. The contractor shall provide hourly Service Rates, performed by a factory trained technician for this installed Life Safety System with the submittal. Proof of training shall be included with the submittal. These hourly service rates shall be guaranteed for a 1-year period.

C. Contract close-out Submittals
1. Deliver two (2) copies of the following to the owner's representative within Thirty (30) days of system acceptance. The closeout submittals shall include:
a. Installation and Programming manuals for the installed Life Safety System.
b. Point to point diagrams of the entire Life Safety System as installed. This shall include all connected Smoke Detectors and addressable field modules.
c. All drawings must reflect device address as verified in the presence of the engineer and/or end user.

D. Warranty
1. Warranty all materials, installation and workmanship for a three (3) year period, unless otherwise specified. A copy of the manufacturer warranty shall be provided with the close out documentation.

E. Products
1. This Life Safety System Specification must be conformed to in its entirety to ensure that the installed and programmed Life Safety System will accommodate all the requirements and operations required by the building owner. Any specified item or operational feature not specifically addressed prior to the bid date will be required to be met without exception.
2. Submission of product purported to be equal to those specified herein will be considered as possible substitutes only when all the following requirements have been met:
3. Any deviation from the equipment, operations, methods, design or other criteria specified herein must be submitted in detail to the specifying Architect or Engineer a minimum of ten (10) working days prior to the scheduled submission of bids. Each deviation from the operation detailed in these specifications must be documented in detail, including page number and section number, which lists the system function for which the substitution is being proposed.
4. A complete list of such substituted products with three (3) copies of working drawings thereof shall be submitted to the approved Architect and/or Consulting Engineer not less than ten (10) working days prior to the scheduled submission of bids.
5. The contractor or substitute bidder shall functionally demonstrate that the proposed substitute products are in fact equal in quality and performance to those specified herein.

F. General Equipment and Materials Requirements
1. All equipment furnished for this project shall be new and unused. All components shall be designed for uninterrupted duty. All equipment, materials, accessories, devices and other facilities covered by this specification or noted on the contract drawings and installation specification shall be best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this specification is provided by different manufacturers, then that equipment shall be “Listed” as to its compatibility by Underwriters Laboratories (UL), if such compatibility is required by UL standards.

G. Satisfying the Entire Intent of these Specifications
1. It is the contractor’s responsibility to meet the entire intent of these specifications.
2. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the architect, engineer, and owner’s representative.
3. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the electrical contractor.

PART 2 PRODUCTS

2.01 GENERAL

A. Control Panel
1. The fire alarm control panel (FACP) shall be the Silent Knight 6700 analog addressable fire alarm control panel. The FACP must have a 2.5 amp power supply and be capable of expansion to a minimum of 50.5 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.
2. The FACP must have Drift Compensation sensitivity capabilities on detectors and be able to support 50 detectors and 50 analog addressable modules. The communication protocol on the SLC loop must be digital.
3. The FACP must support a minimum of two programmable notification circuits. The panel must have a built in 80-character LCD annunciator with the capability of having additional supervised remote annunciators connected in the field.
4. The FACP must have a built-in UL approved IP and digital communicator with the option of adding a cellular module for communications. The communicator must allow local up/downloading of system operating options, event history, and detector sensitivity data.
5. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

6. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have a maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode, Jumpstart®, and the ability to upgrade the core operating software on site through USB or Ethernet cable.
7. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system. Panels that do not have these capabilities will not be accepted.
8. The main communication bus (S-BUS RS485) shall be capable of Class A or class B configuration with a total Bus length of 6,000 feet.

B. System Wiring
1. The Signaling Line Circuit (SLC) and Data Communication Bus (S-BUS) shall be wired with standard NEC 760 compliant wiring, no twisted, shielded or mid capacitance wiring is required for standard installations. All FACP screw terminals shall be able to accept 12-18 AWG wire. All system wiring shall be in accordance with the requirements of NFPA 70, the National Electrical Code (NEC) and comply with article 760 of the NEC.

C. Signaling Line Circuits
1. The SLC shall be capable of a wiring distance of up to 12, 500ft from the SLC driver module and be capable of supporting 50 detectors and 50 modules. Length is determined by wire type and gauge. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 10 seconds. The SLC shall be capable of functioning in a Class A or Class B configuration.

D. SLC Loop Devices
1. Devices supported must include photoelectric smoke detectors, heat detectors, combination fire and CO detectors, contact monitoring modules and relay output modules. There is to be no limit to the number of any particular device type, up to the maximum of 50 detectors and 50 modules that can be connected to the SLC.

E. Addressable detector functions
1. The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:
2. Automatic compliance with NFPA 72 standards for detector sensitivity testing
3. Drift compensation to assure detector is operating correctly
4. Maintenance alert when a detector nears the trouble condition
5. Trouble alert when a detector is out of tolerance
6. Alert control panel of analog values that indicate fire.

F. Programmable Notification Circuits
1. The FACP shall support two programmable notification circuits that are capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable, door holder power or sounder base synchronization. These circuits can be configured as 2 Class B outputs or 1 Class A output.

G. Addressable Notification Module
1. The contractor shall furnish and install where indicated on the plans, addressable notification modules, Silent Knight model SK-Control. The modules shall be U.L. listed compatible with the Silent Knight 6700 fire alarm control panel.
2. The notification module must provide one Class A (Style Z) or Class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The SK-Control shall reside on the SLC loop and can be placed up to 12,500ft. from the FACP.

H. Built-in Annunciators

1. The main control must have a built-in annunciator with an 80-character LCD display and feature LEDs for General alarm, Supervisory, System trouble, System silence, and Power. When in the normal condition the LCD shall display time and date based on a 200-year clock which is capable of automatic daylight savings time adjustments. The annunciator must be able to Silence, Acknowledge, and Reset alarms by using the built-in keypad. The annunciators must be able to program up to 20 levels of user codes that will allow the limitation of operating system programming to authorized individuals.

I. Remote Annunciators
1. The fire system shall be able to support up to eight remote annunciators. The exact number will be determined by type, LCD or LED. LED Remote annunciators shall have individually mapped LEDs and reset and silence input. Remote annunciators shall be capable of operating at a distance of 6,000ft from the main control panel on unshielded non-twisted cable.

J. I/O LED Driver Module
1. The fire system shall be able to support up to eight I/O modules on the SBUS that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and shall be suitable for alarm and trouble circuits as well as reset and silence switches. These driver boards shall contain 80 LED outputs that are powered by an external power source.

K. Serial Parallel Interface
1. The fire system shall able to support up to two serial / parallel interfaces that are able to drive standard computer-style printers (line printers only). The interface shall be programmable as to what information is sent to it and shall include the ability to print out Detector Status, Event History and System Programming.

L. Distributed Power Module
1. The contractor shall supply power modules, Models 5496 and 5895XL, compatible with the model 6700 fire alarm control panel. The power module must have 6 amps of output power, six Flexput® circuits rated at 3 amps each, and two form C relay circuits rated at 2.5 amps at 24 volts DC. The six Flexput circuits shall be capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power. The circuits shall also be programmable as input circuits in Class A or B configurations to support dry contact or compatible two wire smoke detectors.
2. The power module shall be capable of being connected via an RS-485 system bus (SBUS) at a maximum distance of 6,000 feet from the main control panel. It shall contain an additional RS-485 system bus that is completely compatible with all 6700 add-on SBUS modules, annunciators, serial/parallel modules and addressable devices. The power module will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6,000 feet from the power module.
3. The 5496 and 5895XL power modules must have 6 amps of output power and four circuits rated at 3 amps each. The four circuits can be programmed as notification outputs or auxiliary power outputs of door holder, constant, resettable and sounder base synchronization types.
4. The 6700 shall be able to support up to eight (8) of the Distributed Power Modules in any combination. The power module's RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

M. Digital Communicator
1. The digital/IP communicator must be an integral part of the control panel and be able to report all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct numeric codes to a central station or remote station. The communicator must also be capable of up/downloading all system programming options, event history and detector sensitivity compliance information to a PC on-site through a USB or Ethernet cable. It shall transmit the information by one or more of the following means of communication – internet, cellular or standard telephone lines.

2. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage. No controls that use external modems for remote programming and diagnostics shall be accepted.

N. Dry Contacts
1. The FACP shall have three Form “C” dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, supervisory, notification, pre-alarm, waterflow, manual pull, aux. 1 or aux. 2 conditions. The trouble contact shall be normal in an electrically energized state (fail-safe) so that any total power loss (AC and Backup) will cause a trouble condition. If the microprocessor on the FACP fails, the trouble contacts shall also indicate a trouble condition.

O. Ground Fault Detection
1. A ground fault detection circuit shall be employed which can detect a ground fault on both the positive and negative side of each circuit. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground faults shall not interfere with normal operation, such as alarm, or other trouble conditions.

P. Over-current Protection
1. All low voltage circuits will be protected by microprocessor controlled power limiting or have self-restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

Q. Test Functions
1. A “Lamp Test” mode shall be a standard feature of the fire alarm control panel and shall test all LEDs and the LCD display on the main panel and remote annunciators. A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for six seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested, the zone tripped, the zone restored, and the individual points return to normal.
2. A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.
3. A “Disable Mode” shall allow for any zone, point, group, or NAC circuit to be disabled without affecting the operation of the total fire system.

R. Remote Input Capabilities
1. The control panel shall have provisions for supervised switch inputs, for the purpose of Alarm reset and Alarm and Trouble silence.

S. Notification Appliance Mapping Structure
1. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 125 output groups. Each of these groups shall be able to be triggered by any of the panels 125 zones. A group may be triggered from a zone individually, or may contain a global trigger for manual pull stations, fire drills and two different system alarms.
2. Each zone will individually control the cadence pattern of each of the groups that it is “Mapped” to so that sounders can indicate a variety of conditions. The zone shall able to issue a different cadence pattern for each of the groups under its control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices.
3. Zones shall have eight different output categories; Detector alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual pull, Zone auxiliary one and Zone Auxiliary two. Each of the categories shall be able to control from 1 to 8 output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California code, Zone 1 coded, Zone 2 coded, Zone 3 coded, Zone 4 coded, Zone 5 coded, Zone 6 coded, Zone 7 coded, Zone 8 coded, Custom output pattern 1, Custom output pattern 2, Custom output pattern 3, Custom output pattern 4 and Constant.

4. In addition, synchronization is built-in for Amseco®, Gentex®, System Sensor®, and Wheelock® devices. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

T. Downloading Software
1. The fire alarm control panel must support up/downloading of system programming from a PC under Windows or NT environments. The FACP must also be able to upload the detector sensitivity test results and a 1000 event system event buffer to the PC.
2. Communication shall take place over a direct connection to the PC through a USB or Ethernet cable, and/or via the same telephone lines as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or over the ethernet.

U. English Language Descriptions
1. The FACP shall provide the ability to have a text description of each system device input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

2.02 SYSTEM OPERATION

A. Alarm
1. When a device indicates an alarm or supervisory condition the control panel must respond within 3 seconds. The General Alarm or Supervisory Alarm LED on the annunciator(s) shall light and the LCD shall prompt the user as to the number of current events. All notification circuits associated with the alarm or supervisory condition shall activate. If the digital dialer is being utilized it shall transmit a signal to the digital alarm receiving unit.
2. The alarm shall also cause the appropriate door holders and air handlers to shut down. If employed all elevators shall return to the main level or an alternate level when required by the elevator specification or building code. The alarm information must be stored in event memory for later review. Event memory shall be available at the main and all remote annunciators. The alarm memory must be able to store up to 1000 events. When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.
3. An alarm shall be silenced by pressing Silence at the main panel or a code or Firefighter key at the remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal.

B. Troubles
1. When a device indicates a trouble condition, the control panel System Trouble LED should light and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
2. When the device in trouble is restored to normal, the control panel shall be automatically reset. The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by pressing Silence at the main panel or a code or Firefighter key at the remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

C. Supervision Methods
1. The SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

2.03 SYSTEM COMPONENTS

A. System Cabinet
1. Mounting

a. The system cabinet shall be red and can be either surface or flush mounted. The cabinet door shall be easily removable to facilitate installation and service.

B. Audible System Trouble Sounder
1. An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.

C. Power Supply and Charger:
1. The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 2.5 Amps. The FACP must have a battery charging circuit capable of complying with the following requirements:
   a. Twenty-four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period (as required per NFPA 72 central station signaling requirements) using rechargeable batteries with automatic charger to maintain gel-cell batteries in a fully charged condition.
   b. The power supply shall comply with UL Standard 864 for power limiting.
   c. The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A “Battery Test” will be performed automatically every minute to check the integrity of the batteries. The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.
   d. If it is necessary to provide additional power one or more of the model 5496 or 5895XL distributed power modules shall be used to accomplish this purpose.

D. Connections and Circuits
1. Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Electrical Code (NEC) and the local authority having jurisdiction (AHJ).
2. The circuit and connections shall be mechanically protected.
3. A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked “FIRE ALARM CIRCUIT CONTROL”.

2.04 ACCESSORY COMPONENTS

A. The FACP shall support the following devices on the RS-485 data bus:

6860	Remote Annunciator
5860	LCD Remote Annunciator
5824	Printer Interface Module
5865-3	LED Remote Annunciator
5865-4	LED Remote Annunciator with reset and silence switches
5880	LED I/O module
5883	Relay Interface Board
5895XL	Intelligent Distributed Power Module
5496	Intelligent Remote Power Supply 6.0 Amp
SK-NIC	Network Interface Card
SK-NIC-KIT	Installation Accessory Kit
SK-FML	Fiber Module, Multi-Mode
SK-FSL	Fiber Module, Single-Mode

B. The FACP shall support the operation of 50 detectors and 50 addressable modules total devices without regard to device type.
1. The following devices shall be supported:

SK-PHOTO	Addressable Photoelectric Smoke Detector
SK-PHOTO-T	Addressable Photoelectric Smoke Detector with Thermal
SK-PHOTOR	Addressable Photoelectric Smoke Detector with Relay
SK-FIRE-CO	Addressable Combination Photoelectric and CO Detector
SK-HEAT	Addressable Heat Sensor

SK-HEAT-ROR	Addressable Heat with Rate of Rise
SK-HEAT-HT	Addressable Heat High Temp 190°F
SK-ACCLIMATE	Addressable Multi Criteria Smoke Detector with Thermal
SK-6AB	6" detector base
SK-DUCT	Addressable Duct Detector Housing
SK-RELAY	Addressable Relay Module
SK-RELAY-6	Addressable Multi Relay Module
SK-RELAYMON-2	Addressable Relay/Input Module
SK-MONITOR	Addressable Input Module (Class A or B)
SK-MINIMON	Mini Input Module
SK-MONITOR-2	Addressable Dual Input Module
SK-MON-10	Addressable Multi Input Module (10)
SK-CONTROL	Addressable Notification Module
SK-CONTROL-6	Addressable Notification Multi Module (6)
SK-ZONE	Two Wire Smoke Detector Module
SK-ZONE-6	6 Multi Smoke Detector Module
SK-ISO	Isolatuion Module
SK-BEAM	Addressable Beam Detector
SK-BEAM-T	Addressable Bean Detector with Test feature
B224BI	Adressable Isolator base
B224RB	Detector Relay Base
B200S	Intelligent Detector Synchronized Sounder Base
B200S-LF	Intelligent Detector Low Frequency Synchronized Sounder Base
B200SR	Intelligent Detector Sounder Base
B200SR-LF	Intelligent Detector Low Frequency Sounder Base
RTS151KEY	Remote Test Switch for Photoelectric Duct Detector
RTS151	Remote Test Switch for Photoelectric Duct Detector
SK-Pull-SA	Addressable Single Action Pull Station
SK-Pull-DA	Addressable Dual Action Pull Station

The FACP shall support these other Honeywell devices via addressable input, addressable notification, or addressable output modules.
PS-SATK Single Action Manual Pull Station - Key Reset
PS-DATK Dual action Manual Pull Station - Key Reset

C. Furnish and install, where shown on the drawings, the following devices:
   1. Manual Fire Alarm Stations
      a. Manual fire alarm stations shall be non-coded, break glass, single or double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset manual station and open FACP without use of another key. An operated station shall automatically condition itself to be visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed of die cast metal or polycarbonate with clearly visible operating instructions on the front of the stations in raised letters.
      b. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting on a standard single-gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on manual station accessibility or per local requirements.

c. If using conventional pull stations, they must be installed in conjunction with an Addressable Input Module (SK-Monitor) or Mini Input Module (SK-Minimon). Manual stations shall be Silent Knight Model PS-DATK, PS-SATK, and Underwriters Laboratories listed when used with addressable modules.

2. Remote Power Supplies
   a. The remote power supplies for notification appliances shall be the model 5496 and/or 5895XL. The Model intelligent power supply shall wire on the main SBUS and be programmed through the 6700 control. The 5496 will support 6 amps of 24-volt DC power, with 6 Flexput circuits, rated at 3 amps each. The 5895XL will support 6amps of 24-volt DC power, with 6 Flexput circuits, rated at 3amps each. The 5895XL power supply will also regenerate the S-Bus for an additional 6000'.
   b. The 5496 intelligent power supply shall wire on the main SBUS and be programmed through the 6700. It will support 6 amps of 24-volt DC power with 4 notification circuits, rated at 3 amps each.
   c. The remote power supply model 5499 or 5495 may also be used on the system. These power supplies are activated by notification circuit or the SK-CONTROL module and support 24VDC power, with 4 notification circuits, rated at 3 amps each. The total power on a 5495 is 6 amps. The total power on a 5499 is 9 amps. These power boosters may also be activated from another notification circuit from either the fire alarm control, a distributed power supply (RPS-1000).
3. Notification Devices
   a. The visual and audio/visual signaling devices shall be compatible with the 6700, 5495, 5496, 5499, or 5895XL as stated in the installation manuals and be listed with Underwriters Laboratories Inc. per UL 1971 and/or 1638. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.
   b. The notification appliance (combination audio/visual units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The appliance shall be able to meet the candela requirements of the blueprints presented by the Engineer and ADA. The appliance shall be polarized to allow for electrical supervision of the system wiring.
   c. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate. The unit shall have an input voltage range of 19-30 volts. Devices that meet these requirements can be found at www.systemsensor.com, or equivalent.
4. Smoke Detectors
   a. Smoke detectors shall be Honeywell Silent Knight Model SK-PHOTO, ceiling mounted, analog/addressable photoelectric smoke detector, SK-Acclimate multi-criteria photoelectric smoke detector, or the SK-FIRE-CO multi-criteria ceiling mounted fire and carbon monoxide detector. The combination detector head and twist lock base shall be U.L. listed compatible with the Honeywell Silent Knight 6700 fire alarm control panel. The base shall permit direct interchange with the Honeywell Silent Knight SK-ACCLIMATE and SK-HEAT detectors. The base shall be the appropriate twist lock base B210LP.
   b. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment. The vandal security-locking feature shall be used in those areas as indicated on the drawing.

c. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits.
d. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30-mesh insect screen. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

5. Heat Detectors
   a. Furnish and install analog/addressable heat detectors, Honeywell model SK-HEAT. The combination heat detector and twist lock base shall be U.L. listed compatible with the Honeywell 6700 fire alarm control panel. The base shall permit direct interchange with the Honeywell Silent Knight SK-PHOTO, or SK-ACCLIMATE detectors. The base shall be appropriate twist lock base B210LP.
   b. The heat detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The vandal security-locking feature shall be used in those areas as indicated on the drawings. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.
6. Duct Detectors
   a. Duct Detector shall be Honeywell Silent Knight Series Model DNR Duct Detector Housing. A separate SK-PHOTO or SK-PHOTOR is required. The duct detector housing shall be able to house the SK-RELAY module for optional output devices.
   b. SWIFT® Wireless System -- Device Fire Alarm Panel Connectivity
   c. Wireless devices used as components of a fire alarm system shall be capable of connection to the 6700 via a Signaling Line Circuit (SLC) via a gateway. The gateway shall provide the link to one mesh network of wireless devices. Multiple gateways can be supported on the same 6700, limited to (4) wireless mesh networks in the same radio space.
   d. All sensing functions supported for wired devices shall be supported by comparable wireless devices. Additionally, the panel shall allow wired devices to be identified with unique type codes which allow the system to display wireless trouble indications such as low battery, jamming, and tamper.
7. Wireless Reliability
   a. Wireless communication for the wireless system shall incorporate an advanced mesh technology which incorporates UL 864 Class A approved supervised, redundant communication. All devices in the mesh network shall be able to act as repeaters for other devices in the same network. The wireless system shall also have a suite of tools that can be installed on a portable PC and used to assist in qualifying the site, installing the system, and verifying the proper operation of the system.

D. Wireless Approvals
   1. The wireless system shall be approved or listed by the following agencies, as appropriate for each device:
      a. UL
      b. FM
      c. CSFM
      d. FCC

E. Addressable Wireless Devices
   1. The system shall be able to support addressable wireless detectors, monitor modules, and relay modules with similar appearance and capabilities as wired addressable devices.
   2. Wireless devices shall utilize a gateway device to communicate with the fire alarm control panel, so that the wireless devices report to the panel using the established SLC protocol.
   3. Wireless devices shall be capable of co-existing on the same panel with wired devices, and shall be compatible with software zone programming.
   4. Device addressing for wireless device shall be consistent with wired devices, and shall use decade, decimal address switches.

5. Wireless devices (except the gateway) shall operate on batteries recommended by the manufacturer, and shall be UL tested and listed for 2 years of operation on one set of batteries.
6. The gateway shall be connected to the panel SLC loop and shall be capable of being powered by the SLC loop as well. Alternately, the gateway shall be capable of connection to the SLC loop only for communication with the FACP, and power may be supplied via a separate 24VDC input.
7. Wireless devices shall be connected to a compatible fire alarm system, and shall be supported by the system as wireless devices. Trouble conditions that are unique to wireless devices shall be reported to the FACP built-in annunciator and all connected remote annunciators.
8. Wireless devices shall use a UL approved Class A mesh communication protocol to provide redundant supervised wireless communication links.
9. A wireless mesh shall be include one gateway and from one to forty-eight wireless devices. Multiple wireless gateway systems may be connected to a single FACP. The system shall allow for up to four wireless gateway systems in the same radio space.
10. Device status indicators (LEDs) on wireless devices shall not be required to match indications of wired devices, especially for active indications where a steady on LED would reduce the battery life of the device.
11. Wireless detectors shall have dedicated bases with a magnetic tamper mechanism that initiates a trouble when the device is removed from the base. The tamper trouble condition shall latch at the panel until the detector is restored to the normal installed position and the trouble has been reset.
12. Wireless monitor modules shall have a dedicated cover that requires unfastening two screws to remove. The cover shall have a built-in magnet, and removal of the cover shall initiate a trouble condition at the panel. The tamper trouble condition shall latch at the panel until the monitor module is restored to the normal installed position and the trouble has been reset.
13. Wireless monitor modules shall be capable of being mounted in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. The optional surface mount Lexan enclosure shall be used for this purpose, except where installation of the wireless monitor module in a metal box has been tested and adequate performance for the application using the metal box has been confirmed.
14. Wireless devices that can be used shall include these Honeywell SWIFT®:
    a. WSK-PHOTO Wireless Photoelectric Smoke Detector
    b. WSK-ACCLIMATE Wireless Multi-Criteria Photoelectric Smoke Detector
    c. WSK-HEAT-ROR Wireless Heat Rate of Rise Detector
    d. WSK-HEAT Wireless Fixed Heat Detector
    e. WSK-MONITOR Wireless Monitor Module
    f. WSK-RELAY Wireless Relay Module
    g. WSK-WGI Wireless Gateway Module
15. Un-programmed wireless devices shall be capable of being used to perform a site survey to assist in determining the viability of a site for a wireless application. Tests shall include point to point connectivity, and a background RF Scan.
16. A program that supports qualification of potential wireless applications, configuration and installation, and diagnostics shall be available. This program shall be installed on a Windows® PC, and shall able to communicate with wireless devices by use of a USB adapter that plugs into the computer.

PART 3 EXECUTION

3.01 INSTALLER'S RESPONSIBILITIES

A. The installer shall coordinate the installation of the fire alarm equipment. All conductors and wiring shall be installed according to the manufacturer's recommendations. It shall be the installer's responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

3.02 INSTALLATION OF SYSTEM COMPONENTS

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, National Electrical Code, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ).

B. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760. For wire that meets these requirements visit www.honeywellcable.com, or equivalent.

3.03 WARRANTY AND FINAL TEST

A. General

1. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year months from the date of final acceptance.

B. Final Test

1. Before the installation shall be considered completed and acceptable by the awarding authority, a test of the system shall be performed as follows:
   a. The contractor's job foreman, a representative of the owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.
2. At least one half of all tests shall be performed on battery standby power. Where application of heat would destroy any detector, it may be manually activated. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per circuit to check for the presence of correct supervision circuitry.
3. When the testing has been completed to the satisfaction of both the contractor's job foreman and owner, a notarized letter cosigned by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.
4. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by them under this contract within one year (365 days) from the date of final acceptance by the awarding authority.
5. Prior to final test the fire department must be notified in accordance with local requirements.

3.04 AS BUILT DRAWINGS, TESTING, AND MAINTENANCE INSTRUCTIONS

A. "As-Built" Drawings

1. A complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system.

3.05 OPERATING AND INSTRUCTION MANUALS

A. Operating and instruction manuals shall be submitted prior to testing of the system. Three (3) complete sets of operating and instruction manuals shall be delivered to the owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION 28 31 05

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and grubbing.

B. Selective removal and trimming.

C. Debris removal.

1.02 RELATED REQUIREMENTS

A. Section 31 23 23 - Fill: Material for filling holes, pits, and excavations generated as result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.266 - Logging Operations; Current Edition.

B. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning); 2017.

C. ANSI Z133 - American National Standard for Arboricultural Operations - Safety Requirements; 2017.

1.04 QUALITY ASSURANCE

A. Clearing Firm Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

PART 3 EXECUTION

2.01 EXAMINATION

A. Comply with additional requirements specified in Section 01 70 00 - Execution and Closeout Requirements.

B. Identify potential runoff areas.

C. Construction Fencing: See Section 01 50 00 - Temporary Facilities and Controls.

D. Boundary Demarcations: See Section 01 71 23 - Field Engineering.

E. Identify potential dust sources.

F. Identify preexisting debris, junk, and trash on-site.

2.02 PREPARATION

A. Coordinate work with utility companies; notify before starting work and comply with local requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are to remain.

E. Install sedimentation barrier according to Section 01 57 13 - Temporary Erosion and Sediment Control.

F. Develop dust remediation controls and methods. Do not use water if that results in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. Remove preexisting debris, junk, and trash on-site.

2.03 CLEARING AND GRUBBING

A. Clearing: Cut trees, stumps, shrubs, downed timber, and other vegetation for removal within identified area as indicated on drawings according to 29 CFR 1910.266. Follow recommendations of ANSI Z133 and best local practices for species involved.

B. Do not remove or damage vegetation beyond limits indicated on drawings.

2.04 SELECTIVE REMOVAL AND TRIMMING

A. Selective Removal: Individual tree and shrub identified for removal as indicated on drawings according to 29 CFR 1910.266.

B. Selective Trimming: Individual limbs and branches cut back according to ANSI A300 Part 1 identified for removal as indicated on drawings. Follow recommendations of ANSI Z133 and best local practices for species involved.

2.05 REMOVED VEGETATION PROCESSING

A. Do not burn, bury, landfill, or leave on-site, except as indicated on drawings.

B. Trees: Sell if marketable.

END OF SECTION 31 10 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

D. Rigid plastic foam block fill.

E. Lightweight concrete fill.

1.02 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.

B. Section 31 22 00 - Grading: Site grading.

C. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

D. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

E. Section 31 23 16.26 - Rock Removal: Removal of rock during excavating.

F. Section 32 14 13 - Precast Concrete Unit Paving: Leveling bed placement under pavers.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for general requirements applicable to unit prices for earthwork.

1.04 REFERENCE STANDARDS

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)); 2012 (Reapproved 2021).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data for Manufactured Fill.

C. Soil Samples: 10 pounds (4.5 kg) sample of each type of fill; submit in air-tight containers to testing laboratory.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

E. Compaction Density Test Reports.

1.06 QUALITY ASSURANCE

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

E. Verify structural ability of unsupported walls to support imposed loads by the fill.

F. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

G. Verify areas to be filled are not compromised with surface or ground water.

2.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

2.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

G. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

H. Compaction Density Unless Otherwise Specified or Indicated:

I. Reshape and re-compact fills subjected to vehicular traffic.

J. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

2.04 FILL AT SPECIFIC LOCATIONS

2.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

2.06 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Leave unused materials in a neat, compact stockpile.

C. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

D. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 23 23

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 – General Requirements, and the Drawings are collectively applicable to this Section.

1.01 DESCRIPTION OF WORK

The contractor shall provide all labor, materials, equipment and tools necessary for the complete installation of a “no in-fill” synthetic grass dog surface with a stable draining base. The complete synthetic grass system shall consist of, but not necessarily be limited to, the following:

A. Area of construction with the extent of artificial turf work as shown on the drawings.

B. Subgrade, base, and drainage construction as specified in Section 2 and Section 3 of this document.

C. Quality synthetic grass product manufactured in the USA according to specifications in Section 2 of this document. Product shall be a knitted synthetic grass product (not tufted) and contain an antimicrobial agent while meeting or exceeding all guidelines as established herein. For characteristics not specifically stated, shall meet or exceed all guidelines published by the Synthetic Turf Council.

D. The synthetic grass surface shall be specifically designed, manufactured and installed for the intended use as a commercial/high use dog surfacing solution.

E. Plastic perimeter boards (typically 2” x 4” set vertically) are to surround the entire area for anchoring of the turf. The top edge of this surface is to be a minimum of 1/2” below any adjacent solid surfaces where there could be foot traffic.

F. Stainless steel staples, 1” in length, are to be used to anchor the synthetic turf to the perimeter boards.

1.02 SYSTEM PERFORMANCE

Contractor shall ensure that products for pet/dog system meet the following performance requirements:

A. The components, as well as the installation methods utilized, shall be designed and executed in a manner to hold-up to the unique challenges dogs present. The materials as hereinafter specified shall withstand full climatic exposure in the location of the play yard/dog run, be resistant to insect infestation, rot, fungus, mold and mildew, shall also withstand ultra-violet rays and extreme heat, and allow the free flow of water vertically through the surface and into the drainage system below.

B. The seams of all system components shall provide a permanent, tight, secure, and hazard free surface.

C. The installed synthetic grass and drainage system shall allow for drainage and waterflow through the system at a rate of not less than 3” per hour.

1.03 SERVICE AND QUALITY ASSURANCE:

Synthetic grass vendor shall provide ongoing service quality assurance and warranty consisting of, but not necessarily be limited to, the following:

A. The synthetic grass vendor must provide competent workmen skilled in this type of dog surface installation. The synthetic grass vendor shall provide a qualified installation foreman to coordinate and review the component parts of the synthetic grass system. Foreman shall be introduced to owner or owner’s representative prior to start of construction.

B. The synthetic grass vendor and installer must be experienced with no less than six completed commercial dog installations (2500sf or greater) where a knitted synthetic grass surface was installed. Installer must be competent in the installation of this material, including attachment of seams and proper trimming and attaching techniques prior to the start of turf installation.

C. The synthetic grass vendor shall submit its manufacturer’s warranty, which warrants the synthetic grass product:

1. Provide coverage of synthetic grass for a minimum of eight (8) years from the date of substantial completion.
2. Warrant that the materials installed meet or exceed the product specifications.
3. Be from a single source (certified by manufacturer) covering workmanship and all materials.
4. Assure the availability of exact or substantially the same replacement materials for the synthetic grass system for the full warranty period.
5. Include general wear and damage caused by UV degradation. The warranty may specifically exclude vandalism and Acts of God beyond the control of the manufacturer or installer.

1.04 SUBMITTALS:

A. Synthetic grass vendor must submit the following to owner or owner’s representative with the official bid package:

1. One copy of the most recent installation reference list for projects of similar scope to this project completed in last five years.
2. One 12”x12” loose sample of proposed synthetic grass product.
3. One of the product warranty for proposed synthetic grass product.
4. One copy of their maintenance instructions. These instructions will include all necessary instructions for the proper care and maintenance of the newly installed synthetic turf system.
5. One copy of edge details of proposed installation and terminations of synthetic grass playground system.
6. One copy of a signed letter from synthetic grass vendor certifying that the proposed synthetic grass product is manufactured in the USA.
7. One copy (if requested) of independent laboratory test reports on system or components.
8. Recommend there is drainage / water permeability test of sub base.

PART 2 – PRODUCTS

2.01 SYNTHETIC GRASS SYSTEM:

A. Synthetic grass – ForeverLawn K9Grass Classic:

1. Pile Weight: 72 oz/sy
2. Face Yarn Type: Primary: Polyethylene; Secondary: Heat set textured nylon monofilament containing antimicrobial agent
3. Yarn Count: Primary 5,000/4; Secondary 4,200/8
4. Pile Height (knitted): 3/4 “
5. Color: Primary: Summer Green; Secondary: Turf Green
6. Construction: Knitted
7. Antimicrobial Protection: AlphaSan (manufactured into yarn)
8. Tufting Gauge: N/A – knitted product
9. Backing: Flow-through knitted backing with light acrylic coating
10. Seaming: Turf Adhesive
11. Total Product Weight: 87 oz /sy (+/- 2 oz)
12. Finished Roll Width: 15 feet (4.6 m)
13. Finished Roll Length: Up to 150 feet (45.72 m)
14. The synthetic grass shall be delivered in 15’-wide rolls. The rolls will be laid out and installed as specified in the site layout and equipment placement drawings. All seams shall be installed and secured with approved turf adhesive. Seams secured with stitching alone shall not be acceptable.
15. No Infill material is to be used.

B. Products manufactured by Urban Turf Manufacturer: Tom Massey (800) 820-4103, www.urbanturftexas.com in compliance with these specifications may be considered

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

D. Base and Attaching Components: Base is to be prepared using plastic 2” x 4” plastic board and secured using 1” length, 1/4” crown stainless steel staples. Turf is to be secured around all edges.

PART 3 - EXECUTION

3.01 BASE AND DRAINAGE CONSTRUCTION:

The synthetic grass base contractor shall strictly adhere to the installation procedures outlined under this section and by the engineer’s drawings. Any variance from these requirements must be accepted in writing, by the synthetic grass vendor, and submitted to the owner or owner’s representative, verifying that the changes do not adversely affect the performance or warranty.

A. Excavation: Existing ground cover shall be excavated as required by the turf manufacture. The subgrade shall also be compacted to a minimum of a 90% compaction rate.

B. Plastic nailer board: The synthetic turf perimeter fastening structure shall be installed before the drainage aggregate.

1. Install a synthetic nailer board around perimeter and all penetrating objects. Nailer board

shall be flush to grade (or as specified in site detail drawings) when adjacent to soft surface (i.e. natural grass, mulch). Nailer board shall be 1/2” below-grade when adjacent to hard surface (i.e. concrete or tile).

This shall be the responsibility of the synthetic turf base contractor. See synthetic turf edge attachment detail.

C. Base Drainage Aggregate: Installation of the free draining base aggregate of 3/8” to 5/8” clean compactable angular stone (any mix with fines more than 20% must be approved by manufacturer), shall follow procedures provided. If the sub-base does not permit liquids to freely percolate, auxiliary drainage is required. Base material must be installed to a minimum depth of 3-1/2”. The drainage network and its existing elevations shall not be disrupted through ground pressures from trucks, dozers or by any other means.

1. The stone shall be left firm and compacted while allowing the porosity and drainage capabilities of the aggregate profile.
2. The free draining base course should be designed to meet local soil and weather conditions. It must be installed to a minimum depth of 3-1/2” with an overall compaction rate of at least 90%.

3.02 SYNTHETIC GRASS SYSTEM INSTALLATION:

After a final inspection of the stone base by the synthetic grass contractor and the Owner’s Representative, the synthetic turf installation shall begin. The synthetic grass product shall be delivered in 15’-wide rolls.

A. Synthetic grass rolls shall be joined via adhesive bond seaming and reinforced with specialty turf adhesive where necessary.

1. Seams shall be flat, tight and permanent with no separation or fraying.
2. Grass rolls must be installed with pile leaning the same direction.

B. Synthetic Turf Perimeter Attachment:

1. After final layout and seaming of the synthetic grass product, the synthetic turf material shall at a minimum be secured to the top of plastic nailer board firmly anchored to sidewalk, curb, wall or by rebar making up the perimeter of the synthetic turf area. As an alternate installation method, the synthetic turf may be wrapped over the edge of the curb nailer board and secured the full depth of the nailer board.
2. The turf shall be attached to plastic nailer board by stainless steel staples, screws, and/or nails.
3. Soil or surfacing material outside of the defined synthetic turf area shall be backfilled against turf wrapped perimeter edge and have zero transition edge to synthetic turf unless otherwise specified.
4. Concrete and solid surfaces should be 1/2” higher than the top of the board.

C. Infill Application: It is imperative that no in-fill is utilized with synthetic turf used with dogs.

3.03 CLOSEOUT

A. The synthetic grass vendor must verify that a qualified representative has inspected the installation and that the finished surface conforms to the manufacturer's requirements.

B. Extra materials: Owner shall be given option to retain and store excess materials such as excess turf for project, but not installed.

3.04 CLEAN-UP

A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items.

B. During the contract and at intervals as directed by the owner or owner's representative and as synthetic grass system installation is completed, clear the site of all extraneous materials, rubbish, or debris and leave the site in a clean, safe, well-draining, neat condition.

C. Surfaces, recesses, enclosures, etc. shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the owner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Posts, rails, and frames.

B. Concrete.

C. Manual gates with related hardware.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.

D. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.

E. CLFMI CLF-PM0610 - Product Manual; 2017.

F. CLFMI CLF-SFR0111 - Security Fencing Recommendations; 2014.

G. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2023.

H. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

C. Design Calculations: For high wind load areas, provide calculations for fence fabric and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.

D. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Line Posts: 1.9 inch (48 mm) diameter.

B. Corner and Terminal Posts: 2.38 inch (60 mm) diameter.

C. Gate Posts: 3-1/2 inch (89 mm) diameter.

D. Top and Brace Rail: 1.66 inch (42 mm) diameter, plain end, sleeve coupled.

E. Bottom Rail: 1.66 inch (42 mm) diameter, plain end, sleeve coupled.

F. Gate Frame: 1.66 inch (42 mm) diameter for welded fabrication.

G. Tension Wire: 6 gauge, 0.1920 inch (4.9 mm) thick steel, single strand.

H. Tie Wire: Aluminum alloy steel wire.

2.02 MATERIALS

A. Posts, Rails, and Frames: _____:
   1. Line Posts: Type I round in accordance with FS RR-F-191/1D.
   2. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.

B. Concrete: _____:
   1. Type specified in Section 03 30 00.

END OF SECTION 32 31 13

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences.

B. Decorative aluminum fences.

C. Automatic gate operators.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 31 23 16 - Excavation.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.

D. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments; 2024.

E. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction; 2024.

F. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).

G. ASTM F2656/F2656M - Standard Test Method for Crash Testing of Vehicle Security Barriers; 2023.

H. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2023.

I. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.

D. Manufacturer's Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils (0.058 mm), minimum.

C. Aluminum: ASTM B221.
   1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
   2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
   3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

2.03 ALUMINUM FENCE

A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.
   1. Fence Panels: 4 feet (1.2 m) high by 6 feet (1.8 m) long.
      a. Panel Style: Two rail.
      b. Panel Strength: Capable of supporting 270 pounds (122.5 kg) minimum load applied at midspan without deflection.
      c. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
      d. Posts: Aluminum extrusions; 2-1/2 inches (63 mm) square.
      e. Rails: Extruded aluminum channels.
      f. Pickets: Extruded aluminum tubes.
         1) Style: Pickets with finial extend above top rail.
      g. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.
      h. Accessories: Aluminum castings, extrusions, and cold-formed strips; factory finished to match fence.
         1) Flat post cap.
      i. Color: As selected by Architect from manufacturer's standard range.

2.04 SPECIALITY HARDWARE

A. Hinges: Finished to match fence components.
   1. Closing: Manual.
   2. Material: Steel.

B. Latches: Finished to match fence components.
   1. Mechanism: Gravity.
   2. Locking: Mechanical.
   3. Material: Steel.

END OF SECTION 32 31 19

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences.

B. Decorative aluminum fences.

C. Automatic gate operators.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 31 23 16 - Excavation.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.

D. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments; 2024.

E. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction; 2024.

F. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).

G. ASTM F2656/F2656M - Standard Test Method for Crash Testing of Vehicle Security Barriers; 2023.

H. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2023.

I. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.

D. Manufacturer's Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils (0.058 mm), minimum.

C. Aluminum: ASTM B221.
   1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
   2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
   3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

2.03 ALUMINUM FENCE

A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.
   1. Fence Panels: 4 feet (1.2 m) high by 6 feet (1.8 m) long.
      a. Panel Style: Two rail.
      b. Panel Strength: Capable of supporting 270 pounds (122.5 kg) minimum load applied at midspan without deflection.
      c. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
      d. Posts: Aluminum extrusions; 2-1/2 inches (63 mm) square.
      e. Rails: Extruded aluminum channels.
      f. Pickets: Extruded aluminum tubes.
         1) Style: Pickets with finial extend above top rail.
      g. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.
      h. Accessories: Aluminum castings, extrusions, and cold-formed strips; factory finished to match fence.
         1) Flat post cap.
      i. Color: As selected by Architect from manufacturer's standard range.

2.04 SPECIALITY HARDWARE

A. Hinges: Finished to match fence components.
   1. Closing: Manual.
   2. Material: Steel.

B. Latches: Finished to match fence components.
   1. Mechanism: Gravity.
   2. Locking: Mechanical.
   3. Material: Steel.

END OF SECTION 32 31 19

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Benches.

PART 2 PRODUCTS

2.01 STONE FURNISHINGS

A. Benches: Frame and seat section - Refer to Civil
   1. Frame: Cut stone.
   2. Seat: Cut stone.
   3. Length: 86 inches (2184.4 mm).
   4. Height: 17 inches (431.8 mm).
   5. Width: 24 inches (609.6 mm).
   6. Mounting: Surface, using concealed anchor rods.

END OF SECTION 32 33 00

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