Bid Package 02

Canadian County Expo Center
3001 Jensen Road East
El Reno, OK 73036

Bid Package #2 includes the following trade contracts:

1. Trade Package 2-2: Site Utilities
2. Trade Package 2-3: Fences and Gates
3. Trade Package 2-4: Paving & Site Concrete
4. Trade Package 2-5: Concrete Pavers
5. Trade Package 2-6: Landscaping & Irrigation
6. Trade Package 2-7: Equine Protective Surface System
7. Trade Package 3-1: Structural Concrete
8. Trade Package 3-2: Polished Concrete Floors & Sealer
9. Trade Package 4-1: Masonry
10. Trade Package 5-1a: Structural Steel Fabrication
11. Trade Package 5-1b: Structural Steel Erection
12. Trade Package 5-1c: Structural Steel Supply and Erection
13. Trade Package 6-1: Millwork
14. Trade Package 7-1 Waterproofing
15. Trade Package 7-2: TPO Roofing
16. Trade Package 7-3 EIFS
17. Trade Package 8-1: Glass & Glazing
18. Trade Package 8-2: Doors, Frames, & Hardware
19. Trade Package 8-3: Coiling and Sectional Doors
20. Trade Package 9-1 Cold Form Framing & Drywall
21. Trade Package 9-2: Tape, Bed, Paint
22. Trade Package 9-3: Flooring & Tile
23. Trade Package 9-4: Resinous Flooring
24. Trade Package 10-1: Specialties Supply
25. Trade Package 10-2: Misc. & Install
26. Trade Package 10-3: Graphics & Signage
27. Trade Package 10-4 Prefabricated Metal Canopies
28. Trade Package 15-1: Fire Suppression
29. Trade Package 15-2: Mechanical
30. Trade Package 15-3: Plumbing
31. Trade Package 16-1: Electrical & Fire Alarm

Construction Manager:
Lingo Construction
1135 North Robinson Ave.
Oklahoma City, OK 73103

Owner:
Canadian County Public Facilities Authority
201 N Choctaw Ave
El Reno, OK 73036

Architect:
Populous
3151 West Tecumseh Road, Suite 220
Norman, Oklahoma 73072

Table of Contents

Division 0 – Contract & Bidding Documents

End of Table of Contents

Section 00 1000
Solicitation for Bids

April 15, 2020

Lingo Construction Services, Inc. hereinafter called the (CM or Construction Manager), will receive bids on Behalf of the Canadian County Public Facilities Authority in the Public Meeting Room at the Canadian County Administrative Building Thursday May 7th no later than 2:30pm central standard time Bid Package #2 consisting of the following Trade Packages:

Trade Package 2-2: Site Utilities
Trade Package 2-3: Fences and Gates
Trade Package 2-4: Paving & Site Concrete
Trade Package 2-5: Concrete Pavers
Trade Package 2-6: Landscaping & Irrigation
Trade Package 2-7: Equine Protective Surface System
Trade Package 3-1: Structural Concrete
Trade Package 3-2: Polished Concrete Floors & Sealer
Trade Package 4-1: Masonry
Trade Package 5-1a: Structural Steel Fabrication
Trade Package 5-1b: Structural Steel Erection
Trade Package 5-1c: Structural Steel Supply and Erection
Trade Package 6-1: Millwork
Trade Package 7-1 Waterproofing
Trade Package 7-2: TPO Roofing
Trade Package 7-3 EIFS
Trade Package 8-1: Glass & Glazing
Trade Package 8-2: Doors, Frames, & Hardware
Trade Package 8-3: Coiling and Sectional Doors
Trade Package 9-1 Cold Form Framing & Drywall
Trade Package 9-2: Tape, Bed, Paint
Trade Package 9-3: Flooring & Tile
Trade Package 9-4: Resinous Flooring
Trade Package 10-1: Specialties Supply
Trade Package 10-2: Misc. & Install
Trade Package 10-3: Graphics & Signage
Trade Package 10-4 Prefabricated Metal Canopies

Trade Package 15-1: Fire Suppression
Trade Package 15-2: Mechanical
Trade Package 15-3: Plumbing
Trade Package 16-1: Electrical & Fire Alarm

The bids shall be enclosed in a sealed envelope plainly marked and addressed in the upper right-hand corner to:

Canadian County Public Facilities Authority
Attn: Sherry Murray / Canadian County Expo Bid Package #01
201 N Choctaw Ave
El Reno, OK 73036

The name and address of the bidder shall appear on the lower right corner of the envelope along with the bid package number and description. Provide a separate envelope for each Trade Package submitted. Non-mandatory pre-bid site tours will be held on site Monday, April 27th, 2020; 3:30pm. Pre-bid RFI's are due to the CM (Jacob.lingo@buildwithlingo.com) by 5:00 pm Wednesday April 29, 2020.

The bids will be publicly opened and read aloud at the above-mentioned office following the closing time stated above. Bids received after the stated time or more than 96 hours, excluding Saturdays, Sundays, and holidays, before the stated time will not be accepted. **Lingo asks all bidders to consider participating in the bid opening via Go To Meeting at the following phone number (646) 749-3122 Access Code: 307-470-421 rather than attending in person due to social distancing concerns.**

Section 00 1000
Solicitation for Bids

For bids in excess of $50,000 a cashier's check, certified check, or surety bond in the amount of five percent (5%) of the bid shall accompany the sealed proposal of each bidder. After the scheduled closing time for bids for a period of thirty (30) days no bids may be withdrawn.

Plans and specifications may be obtained in the following formats:

1. Plans and specifications are available online through Building Connected.
   Please email the CM to arrange for access at Jacob.lingo@buildwithlingo.com (405)602-2100
2. Paper plans and specifications may be obtained from **Reidprographics**
   6800 N Shartel Ave, OKC, OK 73116 PH: (405) 848-7274 at the cost of reproduction.
3. Plan Rooms:
   a. **Dodge Lead Center and Associated General Contractors** PH: (405) 301-7095
   b. **Southwest Construction News Service** PO Box 57090, 2811 NW 36th , Oklahoma City, OK 73157 PH: (405) 948-7474

Lingo Construction Services, Inc and the owner reserve the right to reject any or all bids or to waive any formalities or irregularities in any bid, and to accept the bid or bids which are in the best interest of the owner.

Complete, sign and include Bid Form and Bid Affidavits in the sealed envelope.

End of Solicitation for Bids

Bid Form

Canadian County Expo Center

BID PACKAGE 2

Project: Canadian County Expo Center

To: Canadian County Public Facilities Authority
201 N. Choctaw Ave.
El Reno, OK 73036

Bidder: _____
Name

Company: _____
Name

Bidders:

1. The undersigned, having carefully reviewed the plans, specification, addenda, and related documents as well as the on-site field conditions and being familiar with the availability of materials and labor, herby proposes to furnish all materials, equipment, and labor required to provide all work called for by said documents for the following Trade Package:

   Trade Bid Package # _____Description_____

2. Base Bid (Including Bond Cost):

   Words: _____

   Dollars: $_____

3. Alternates: Fill this section out completely. Items left blank will be taken as a no cost change.
   a. Alternate 01 Stall Barn – $_____Add/(Deduct) (Refer bid packages for base bid/alternate clarifications).
   b. Alternate 02 (Refer Trade Package)- $_____Add/(Deduct) (Refer bid packages for base bid/alternate clarifications).
   c. Alternate 03 (Refer Trade Package)- $_____Add/(Deduct) (Refer bid packages for base bid/alternate clarifications).
   d. Alternate 04 (Refer Trade Package)- $_____Add/(Deduct) (Refer bid packages for base bid/alternate clarifications).
   e. Alternate 05 (Refer Trade Package)- $_____Add/(Deduct) (Refer bid packages for base bid/alternate clarifications).
4. Bidder acknowledges receipt of addenda numbers _____, and clarifications _____, issued during the time of bidding and has included changes therein into bid.

Section 00 2000 BID FORM

5. Quantity Check (See bid package for instructions): _____

   _____
   _____
   _____

6. For bids more than $50,000 a cashier's check, certified check, or surety bond in the amount of five percent (5%) of the bid shall accompany the sealed proposal of each bidder. After the scheduled closing time for bids for a period of thirty (30) days no bids may be withdrawn. (Bonds to be made out to Canadian County Public Facilities Authority & Lingo Construction Services, Inc.)
7. Price shall include cost for payment and performance bonds (for a one year duration). Three sealed hard copies must be provided. Each bond needs to be provided on its own form. Originals can be mailed or dropped off at office of Construction Manager. (Bonds to be made out to Canadian County Public Facilities Authority & Lingo Construction Services, Inc.)
8. Bidder acknowledges that in submitting this bid the Owner reserves the right to reject any and all bids. It is also agreed to that bid may not be withdrawn for a period of thirty (30) days after the date of bid opening. Work is to start within ten (10) days after receipt of Notice to Proceed.
9. Bidder acknowledges that bid does not include substitutions unless protocols outlined in specifications are followed and approved prior to the time of bid. After time of bid substitutions will no longer be considered.
10. Bidder acknowledges that, if accepted by the Owner, this bid form and corresponding bid package becomes a part of the Contract Documents.
11. Bidder acknowledges that by submitting this bid form they agree to follow and has included executed copies of CONTRACT ATTACHMENTS A, B, C, D, E, and F.
12. Certifications:

    Company Name: _____

    Contact Person: _____

    Phone Numbers: (office)_____(cell)_____

    Email: _____

    Fed ID Number: _____

    Business Address: _____

    _____

    By: _____

    Title: _____

    Authorized Signature: _____

    Date: _____

    _____ Notary Public

    _____Commission Expires

Section 00 2100
Bid Affidavits

Bidder acknowledges that by submitting this bid form they agree to follow has included executed copies of CONTRACT ATTACHMENTS A, B, C, D, E, and F.

Company Name: _____

Contact Person: _____

Phone Numbers: (office)_____(cell)_____

Email: _____

Business Address: _____

_____

By: _____

Title: _____

Authorized Signature: _____

Date: _____

_____ Notary Public

_____Commission Expires

Contract Attachment A: NON-COLLUSION AFFIDAVIT

The following Affidavit is submitted by the Bidder, or Bidder's Authorized Agent: The undersigned of lawful age, being first duly sworn on oath, affirms and says:

1. The undersigned is the Bidder or the duly authorized agent of the Bidder submitting this competitive bid and has the lawful authority to execute this Affidavit and the attached Bid. For the purposes of certifying the facts pertaining to the existence of collusion among bidders and between bidders and Owner's officials or employees, as well as facts pertaining to the giving or offering of things of value to government personnel in return for special consideration in the letting of any contract pursuant to the Bid to which this statement is attached:
2. The undersigned is fully aware of the facts and circumstances surrounding the making of the Bid to which this statement is attached and has been personally and directly involved in the proceedings leading to the submission of such Bid; and
3. Neither the Bidder nor anyone subject to the Bidder's direction or control has been a party:
    a. to any collusion among bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding;
    b. to any collusion with any official, agent or employee as to quantity, quality or price in the prospective contract, or as to any other terms of such prospective contract;
    c. nor in any discussion between bidders and any official, agent, or employee concerning exchange of money or other thing of value for special consideration in letting of a contract.

4. The undersigned certifies, if awarded this contract neither the Bidder nor anyone subject to Bidder's direction or control has paid, given, or donated or agreed to pay, give or donate to any officer or employee of the Putnam City School District any money or other thing of value, either directly or indirectly, in procuring this contract.

_____

(contractor or supplier) (signature)

Contract Attachment B: BUSINESS RELATIONSHIP AFFIDAVIT

The following Affidavit is submitted by the Bidder, or Bidder's Authorized Agent: The undersigned of lawful age, being first duly sworn on oath, affirms and says:

A. I further certify that the nature of any partnership, joint venture or other business relationships presently in effect or which existed within one (1) year prior to the date of this statement with the Architect, Engineer, or other party of the project is:

_____

(If none, so state; use additional sheet if necessary.)

B. That any such business relationship presently in effect or which existed within one (1) year prior to the date of this statement between any officer or director of the bidding company and any officer or director of the Architectural or Engineering firm or other party to the project is:

_____

(If none, so state; use additional sheet if necessary.)

C. And that the names of all persons having any such business relationships and the positions they hold with their respective companies or firms are:

_____

(If none of the business relationships herein above mentioned exist, then a statement to that effect. Use additional sheet if necessary.)

_____

(contractor or supplier) (signature)

Section 00 2100
Bid Affidavits

Contract Attachment C: SAFETY POLICY AFFIDAVIT

The following Affidavit is submitted by the Bidder, or Bidder's Authorized Agent: The undersigned of lawful age, being first duly sworn on oath, agrees to abide by the following safety policies:

The Trade Contractor shall be responsible for compliance with all safety rules and regulations under the Occupational Safety and Health Act and other pertinent statutes and ordinances in connection with the work performed by the Trade Contractor. Trade Contractor will also abide by any site specific or hazardous material safety measures as requested and deemed necessary by Contractor's management and/or field supervision.

Trade Contractor acknowledges that hazards may be present, including but not limited to: silica, lead based paint, and asbestos, and will communicate with Contractor to understand jobsite hazard conditions prior to starting work. Basic Personal Protective Equipment (PPE) including hard hats, safety glasses, and vests are required in accordance with site specific safety conditions.

Failure to comply with OSHA and site-specific safety requirements may, after one (1) written warning, result in expulsion from the site by the Contractor's project manager or on-site supervisor.

If applicable, Trade Contractor shall prepare, submit, and maintain a HAZCOM Program specific to the project, including identifying who will be the designated competent safety person on the job site.

This bid will not be considered unless this form has been fully completed and signed and certified by the Bidder.

_____

Name of Individual, Partnership, Limited Liability Company, or Corporation hereinafter called Bidder

_____

Signature of Bidder or Bidder's Authorized Agent

_____

Type or print name and title of person who signed above.

Contract Attachment D: PROJECT MANAGEMENT AFFIDAVIT

State of _____)

) SS.

Section 00 2100
Bid Affidavits

County of _____)

_____ (contractor) hereby certifies that they agree to the following project management requirements:

1. Provide a Qualified Foreman - Subcontractor will assign full time ***Responsible*** *Person in Charge* (RPIC) with a minimum 5 years' experience to manage subcontractors crew(s) while on site. The responsible person in charge will have the authority to execute sub-contractors scope of work, order materials, answer questions, schedule work and secure workers. The RPIC will attend the project meeting every week as scheduled and at least one week prior to mobilizing on site. The RPIC will attend daily coordination and safety huddles (10-15 Minutes).

2. Provide Appropriate Crew Size – As qualified subcontractor on this project we understand the scope of work in the documents and the project size may require multiple crews working in several areas at the same time. We have the resources and intent to staff the job appropriately to keep up with the flow of work in all areas made ready by preceding subcontractors.

3. Good Housekeeping – Subcontractor will maintain a safe work site which starts with a clean work site. Contracts and good construction practice require that subcontractor's crews clean work areas at the end of each day. Poor housekeeping is unsafe for others, costs time in lost production and will not be tolerated. Housekeeping is in the documents, in the contracts and in the bid.

_____

(contractor or supplier) (signature)

Contract Attachment E: Hazard Notification

Construction Manager acknowledges the following hazards for this project:

1. There are no known lead hazards.
2. Silica is present in masonry products such as brick, concrete, Sheetrock, block and all masonry work.

The following Affidavit is submitted by the Bidder, or Bidder's Authorized Agent: The undersigned of lawful age, being first duly sworn on oath, affirms and says:

1. Regarding silica, it is the Trade Contractors responsibility to abide by rules and regulations in CFR 1926 & CFR 1910 (This is the official notification of hazard present).
2. This is a notification of conditions that cannot be detected such as, in walls, under windows, door jambs, between walls, or any other area that requires demo to get to.

There can possibly be hazards in those locations that were not detected. It is the Trade Contractors responsibility to take proper safety precautions.

The undersigned agrees that they have received notification of the above hazards and agrees to comply with the rules and regulations listed above throughout the construction of this project.

_____

(contractor or supplier) (signature)

Contract Attachment F: CONTRACT DRAWING, SPECIFICATIONS, REPORTS PACKAGE AFFIDAVIT

I hereby attest by signature that I have read and understand the drawing, specifications, project manual, and reports listed below. I also understand that they may be modified and updated at any time throughout the duration of the project, but not without notice to the selected bidders.

DRAWING & DESCRIPTION

Drawing No.	Drawing Title	Revision	Drawing Date	Set Name
X0-1	COVER SHEET	1	3/20/2020	Bid Package #02 - Permit Set
X0-1-1	DRAWING SHEET INDEX	1	3/20/2020	Bid Package #02 - Permit Set
LS1-1	CODE ANALYSIS & LIFE SAFETY - MAIN BUILDING	1	3/20/2020	Bid Package #02 - Permit Set
LS1-2	CODE ANALYSIS & LIFE SAFETY - MAINTENANCE BUILDING	1	3/20/2020	Bid Package #02 - Permit Set
C1-0	Civil Cover Sheet	2	3/20/2020	Bid Package #02 - Permit Set
C1-1	EXISTING SURVEY	2	3/20/2020	Bid Package #02 - Permit Set
C1-2	GENERAL NOTES	2	3/20/2020	Bid Package #02 - Permit Set
C1-3	STREET TYPICAL	2	3/20/2020	Bid Package #02 - Permit Set
C2-0	CIVIL SITE PLAN	2	3/20/2020	Bid Package #02 - Permit Set
C2-1	LAYOUT AND DIMENSIONS NORTHEAST ENTRANCE	1	3/20/2020	Bid Package #02 - Permit Set
C2-2	LAYOUT AND DIMENSIONS EAST	1	3/20/2020	Bid Package #02 - Permit Set
C2-3	LAYOUT AND DIMENSIONS STALL BARN	1	3/20/2020	Bid Package #02 - Permit Set
C2-4	LAYOUT AND DIMENSIONS MAIN BUILDING	1	3/20/2020	Bid Package #02 - Permit Set
C2-5	LAYOUT AND DIMENSIONS PARKING LOT	1	3/20/2020	Bid Package #02 - Permit Set
C2-6	LAYOUT AND DIMENSIONS SOUTH ENTRANCE	1	3/20/2020	Bid Package #02 - Permit Set

C2-7	LAYOUT AND DIMENSIONS DETENTION POND	1	3/20/2020	Bid Package #02 - Permit Set
C2-8	LAYOUT AND DIMENSIONS PARKING LOT	1	3/20/2020	Bid Package #02 - Permit Set
C2-9	PROJECT NO.	0	3/20/2020	Bid Package #02 - Permit Set
C3-0	DEMOLITION PLAN	2	3/20/2020	Bid Package #02 - Permit Set
C4-0	EXISTING DRAINAGE AREA MAP (PONDS)	2	3/20/2020	Bid Package #02 - Permit Set
C4-1	PROPOSED DRAINAGE AREA MAP PONDS	2	3/20/2020	Bid Package #02 - Permit Set
C4-2	PROPOSED DRAINAGE AREA MAP (CULVERTS)	1	3/20/2020	Bid Package #02 - Permit Set
C5-0	ROADWAY PLAN & PROFILE STA 200+00 TO 210+00	2	3/20/2020	Bid Package #02 - Permit Set
C5-1	PLAN & PROFILE STA 210+00 TO 219+37	0	3/20/2020	Bid Package #02 - Permit Set
C5-2	PLAN & PROFILE STA 220+00 TO 225+65	0	3/20/2020	Bid Package #02 - Permit Set
C6-0	OVERALL GRADING AND DRAINAGE PLAN & KEYMAP	2	3/20/2020	Bid Package #02 - Permit Set
C6-1	GRADING PLAN NORTHEAST ENTRANCE	2	3/20/2020	Bid Package #02 - Permit Set
C6-2	GRADING PLAN EAST	2	3/20/2020	Bid Package #02 - Permit Set
C6-3	GRADING PLAN STALL BARN	2	3/20/2020	Bid Package #02 - Permit Set
C6-4	GRADING PLAN MAIN BUILDING	2	3/20/2020	Bid Package #02 - Permit Set
C6-5	GRADING PLAN PARKING LOT	2	3/20/2020	Bid Package #02 - Permit Set
C6-6	GRADING PLAN SOUTH ENTRANCE	2	3/20/2020	Bid Package #02 - Permit Set
C6-7	GRADING PLAN DETENTION POND	2	3/20/2020	Bid Package #02 - Permit Set
C6-8	GRADING PLAN GRAVEL PARKING LOT	0	3/20/2020	Bid Package #02 - Permit Set
C7-0	OVERALL UTILITY PLAN	2	3/20/2020	Bid Package #02 - Permit Set
C8-0	STORM SEWER PLAN & PROFILE LINE 1 - SOUTH OF EXPO LINE 2 - NE ENTRANCE	2	3/20/2020	Bid Package #02 - Permit Set
C8-1	STORM SEWER PLAN & PROFILE LINE 3 - SOUTH ENTRANCE	2	3/20/2020	Bid Package #02 - Permit Set
C8-2	STORM SEWER PLAN & PROFILE LINE 4 - DETENTION POND LINE 5 PLAZA TO DET POND	2	3/20/2020	Bid Package #02 - Permit Set
C8-3	STORM SEWER PLAN & PROFILE LINE 5 - PLAZA ROOF DRAIN	1	3/20/2020	Bid Package #02 - Permit Set
C9-0	SANITARY SEWER PLAN & PROFILE LINE A NORTHWEST OF EXPO	2	3/20/2020	Bid Package #02 - Permit Set
C9-1	SANITARY SEWER PLAN & PROFILE LINE B MAINT BLDG TO SAN TANK	2	3/20/2020	Bid Package #02 - Permit Set
C9-2	SANITARY SEWER PLAN & PROFILE LINE B MAINT BLDG TO SAN TANK	2	3/20/2020	Bid Package #02 - Permit Set
C9-3	SANITARY SEWER PLAN & PROFILE LINE C MAIN BLDG EAST TO LINE B	2	3/20/2020	Bid Package #02 - Permit Set

Section 00 2100
Bid Affidavits

C9-4	FIRE LINE VAULT & GAS CROSSING PROFILES	0	3/20/2020	Bid Package #02 - Permit Set
C10-0	SWPPP	1	3/20/2020	Bid Package #02 - Permit Set
C10-1	EROSION CONTROL PLAN	1	3/20/2020	Bid Package #02 - Permit Set
C11-0	ADA COMPLIANCE & PAVEMENT DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
C11-1	SANITARY DUMP STATION & FDC DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
C11-2	FDC & WATER METER VAULT DETAILS	0	3/20/2020	Bid Package #02 - Permit Set
L1-0	PLANTING PLAN	2	3/20/2020	Bid Package #02 - Permit Set
L1-1	PLANTING DETAILS	2	3/20/2020	Bid Package #02 - Permit Set
L1-2	PLANTING DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
L2-0	IRRIGATION PLAN	2	3/20/2020	Bid Package #02 - Permit Set
S1-00	GENERAL NOTES	1	3/20/2020	Bid Package #02 - Permit Set
S1-01	GENERAL NOTES	1	3/20/2020	Bid Package #02 - Permit Set
S1-02	STATEMENT OF SPECIAL INSPECTIONS	1	3/20/2020	Bid Package #02 - Permit Set
S1-03	TYPICAL FOUNDATION DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S1-04	TYPICAL STEEL DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S1-05	TYPICAL STEEL JOIST DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S1-06	TYPICAL LIGHT GAGE STEEL DETAILS	0	3/20/2020	Bid Package #02 - Permit Set
S2-00	OVERALL FOUNDATION PLAN - MAIN BUILDING	1	3/20/2020	Bid Package #02 - Permit Set
S2-1A	FOUNDATION PLAN - AREA A PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S2-1B	FOUNDATION PLAN - AREAS B PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S2-1C	FOUNDATION PLAN - AREAS C PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S2-1D	FOUNDATION PLAN - AREA D PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S2-1E	FOUNDATION PLAN - AREA E PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S2-1F	FOUNDATION PLAN - AREA F PLAN (ALT. NO. 1)	1	3/20/2020	Bid Package #02 - Permit Set
S3-01	OVERALL MAIN BUILDING LO ROOF FRAMING PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-1A	LOW ROOF FRAMING PLAN - AREA A PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-1B	LOW ROOF FRAMING PLAN - AREA B PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-1C	LOW ROOF FRAMING PLAN - AREA C PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-1D	LOW ROOF FRAMING PLAN - AREA D PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-1E	ROOF FRAMING PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-1F	ROOF FRAMING PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-2C	PARAPET FRAMING PLAN	1	3/20/2020	Bid Package #02 - Permit Set

S3-3B	HI ROOF FRAMING PLAN - AREA B PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-3C	HI ROOF FRAMING PLAN - AREA C PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S3-3D	HI ROOF FRAMING PLAN - AREA D PLAN	1	3/20/2020	Bid Package #02 - Permit Set
S4-0	FRAMING ELEVATIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S4-1	FRAMING ELEVATIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S4-2	FRAMING ELEVATIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S5-1	FOUNDATION SECTIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S5-2	FOUNDATION SECTIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S6-1	FRAMING SECTIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
S6-2	FRAMING SECTIONS & DETAILS	1	3/20/2020	Bid Package #02 - Permit Set
A0-1-1	ARCHITECTURAL GRAPHIC STANDARDS	1	3/20/2020	Bid Package #02 - Permit Set
A0-1-2	TYPICAL TOILET LAYOUTS AND ACCESSORIES	1	3/20/2020	Bid Package #02 - Permit Set
A0-3-1	BUILDING PERSPECTIVES	1	3/20/2020	Bid Package #02 - Permit Set
A0-3-2	BUILDING PERSPECTIVES	1	3/20/2020	Bid Package #02 - Permit Set
A1-0	ARCHITECTURAL SITE PLAN	1	3/20/2020	Bid Package #02 - Permit Set
A1-1	REFERENCE PLAN - GROUND LEVEL	1	3/20/2020	Bid Package #02 - Permit Set
A2-1A	FLOOR PLAN - AREA A PLAN	1	3/20/2020	Bid Package #02 - Permit Set
A2-1B	FLOOR PLAN - AREA B PLAN	1	3/20/2020	Bid Package #02 - Permit Set
A2-1C	FLOOR PLAN - AREA C PLAN	1	3/20/2020	Bid Package #02 - Permit Set
A2-1D	FLOOR PLAN - AREA D PLAN	1	3/20/2020	Bid Package #02 - Permit Set
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SPECIFICATION & DESCRIPTION

Spec Section	Description	Revision	Issued Date
00 01 05.1	Architectural Certification	0	3/20/2020
00 01 05.2	Civil Certifications	0	3/20/2020
00 01 05.3	Landscape Certification	0	3/20/2020
00 01 05.4	Structural Certification	0	3/20/2020
00 01 05.5	Plumbing Certification	0	3/20/2020
00 01 05.6	Mechanical Certification	0	3/20/2020
00 01 05.7	Electrical Certification	0	3/20/2020
00 01 05.9	Fire Protection Certification	0	3/20/2020
00 0100	Title Page	1	4/15/2020
00 0110	Table of Contents	3	4/15/2020
00 1000	Solicitation for Bids	1	4/15/2020
00 2000	Bid Form	1	4/15/2020
00 2100	Bid Affidavits	2	4/15/2020
00 2200	Contractor's Checklist for Bid Submittal	1	4/15/2020
00 3000	Instructions to Bidders	1	4/15/2020
00 3100	Geotechnical Report	1	4/15/2020
00 4000	Sample Contract Form	1	4/15/2020
00 4100	Packet Accompanying Contract	0	1/29/2020

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00 4200	Final Payment Affidavit	1	4/15/2020
00 4300	Certification of Asbestos Free Construction	1	4/15/2020
00 4400	Special Conditions of the Subcontract	1	4/15/2020
00 5000	Trade Package Scopes of Work	2	4/15/2020
00 5100	Bid Package 01 - Addendum 01 Clarifications	0	2/14/2020
00 5200	Bid Package 01 - Addendum 02	0	2/19/2020
00 5201	Bid Package 01 Clarification 01	0	2/19/2020
00 5202	Bid Package 01 Clarification 02	0	2/19/2020
01 10 00	Summary	1	3/20/2020
01 23 00	Alternates	1	3/20/2020
01 25 00	Substitution Procedures	1	3/20/2020
01 25 01	SUBSTITUTION REQUEST FORM	0	3/20/2020
01 26 00	Contract Modification Procedures	1	3/20/2020
01 29 00	Payment Procedures	1	3/20/2020
01 31 00	Project Management and Coordination	1	3/20/2020
01 31 01	Populous Electronic Data Transfer Agreement	1	3/20/2020
01 31 02	REQUEST FOR INFORMATION FORM	0	3/20/2020
01 32 00	Construction Progress Documentation	1	3/20/2020
01 33 00	Submittal Procedures	1	3/20/2020
01 33 01	SUBMITTAL TRANSMITTAL FORM	0	3/20/2020
01 40 00	Quality Requirements	1	3/20/2020
01 42 00	References	1	3/20/2020
01 50 00	Temporary Facilities and Controls	1	3/20/2020
01 60 00	Product Requirements	1	3/20/2020
01 73 00	Execution	1	3/20/2020
01 77 00	Closeout Procedures	1	3/20/2020
01 78 23	Operation and Maintenance Data	1	3/20/2020
01 78 39	Project Record Documents	1	3/20/2020
01 79 00	Demonstration and Training	1	3/20/2020
01 2501.01	Request for Substitution	0	2/13/2020
03 30 00	Cast-in-Place Concrete	0	3/20/2020
03 35 43	POLISHED CONCRETE FINISHING	0	3/20/2020
03 54 16	HYDRAULIC CEMENT UNDERLAYMENT	0	3/20/2020
04 20 00	UNIT MASONRY	0	3/20/2020
04 21 13	Brick Masonry	0	3/20/2020
04 72 00	CAST STONE MASONRY	0	3/20/2020
05 12 00	Structural Steel Framing	0	3/20/2020
05 21 00	Steel Joist Framing	0	3/20/2020
05 31 00	Steel Decking	0	3/20/2020
05 40 00	Cold-Formed Metal Framing	0	3/20/2020
05 50 00	Metal Fabrications	0	3/20/2020
05 52 13	PIPE AND TUBE RAILINGS	0	3/20/2020
06 10 53	MISCELLANEOUS ROUGH CARPENTRY	0	3/20/2020
06 16 00	SHEATHING	0	3/20/2020
06 20 13	EXTERIOR FINISH CARPENTRY	0	3/20/2020
06 20 23	INTERIOR FINISH CARPENTRY	0	3/20/2020
06 41 16	PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS	0	3/20/2020
06 64 00	PLASTIC PANELING	0	3/20/2020
07 13 26	SELF-ADHERING SHEET WATERPROOFING	0	3/20/2020
07 19 00	WATER REPELLENTS	0	3/20/2020
07 21 00	THERMAL INSULATION	0	3/20/2020
07 21 11	PRE-ENGINEERED BUILDING INSULATION	0	3/20/2020
07 21 19	FOAMED-IN-PLACE INSULATION	0	3/20/2020
07 24 19	WATER-DRAINAGE EXTERIOR INSULATION AND FINISH	0	3/20/2020
07 27 26	FLUID-APPLIED MEMBRANE AIR BARRIERS	0	3/20/2020
07 41 13	Metal Roof Panels	0	3/20/2020
07 42 13	Metal Wall Panels	0	3/20/2020
07 54 23	THERMOPLASTIC POLYOLEFIN (TPO) ROOFING	0	3/20/2020

07 62 00	SHEET METAL FLASHING AND TRIM	0	3/20/2020
07 71 00	ROOF SPECIALTIES	0	3/20/2020
07 71 29	MANUFACTURED ROOF EXPANSION JOINTS	0	3/20/2020
07 72 00	ROOF ACCESSORIES	0	3/20/2020
07 72 53	SNOW GUARDS	0	3/20/2020
07 84 13	PENETRATION FIRESTOPPING	0	3/20/2020
07 84 43	JOINT FIRESTOPPING	0	3/20/2020
07 92 00	JOINT SEALANTS	0	3/20/2020
07 95 00	EXPANSION CONTROL	0	3/20/2020
72600	Vapor Retarders	0	3/20/2020
08 11 13	HOLLOW METAL DOORS AND FRAMES	0	3/20/2020
08 14 16	FLUSH WOOD DOORS	0	3/20/2020
08 14 33	STILE AND RAIL WOOD DOORS	0	3/20/2020
08 31 13	ACCESS DOORS AND FRAMES	0	3/20/2020
08 33 13	COILING COUNTER DOORS	0	3/20/2020
08 36 13	SECTIONAL DOORS	0	3/20/2020
08 41 13	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS	0	3/20/2020
08 44 13	GLAZED ALUMINUM CURTAIN WALLS	0	3/20/2020
08 51 13	ALUMINUM WINDOWS	0	3/20/2020
08 56 53	SECURITY WINDOWS	0	3/20/2020
08 71 00	DOOR HARDWARE	0	3/20/2020
08 80 00	GLAZING	0	3/20/2020
08 88 53	SECURITY GLAZING	0	3/20/2020
08 91 19	FIXED LOUVERS	0	3/20/2020
08 95 16	WALL VENTS	0	3/20/2020
09 22 16	NON-STRUCTURAL METAL FRAMING	0	3/20/2020
09 29 00	GYPSUM BOARD	0	3/20/2020
09 30 13	Ceramic Tiling	0	3/20/2020
09 51 23	ACOUSTICAL TILE CEILINGS	0	3/20/2020
09 61 13	FLOOR SEALERS	0	3/20/2020
09 65 13	RESILIENT BASE AND ACCESSORIES	0	3/20/2020
09 65 36	STATIC-CONTROL RESILIENT FLOORING	0	3/20/2020
09 67 23	RESINOUS FLOORING	0	3/20/2020
09 68 00	CARPETING	0	3/20/2020
09 72 19	Textile Wall Coverings	0	3/20/2020
09 77 23	FABRIC-WRAPPED PANELS	0	3/20/2020
09 91 13	EXTERIOR PAINTING	0	3/20/2020
09 91 23	INTERIOR PAINTING	0	3/20/2020
09 93 00	STAINING AND TRANSPARENT FINISHING	0	3/20/2020
09 96 00	HIGH-PERFORMANCE COATINGS	0	3/20/2020
10 14 00	SIGNAGE	0	3/20/2020
10 14 19	DIMENSIONAL LETTER SIGNAGE	0	3/20/2020
10 21 13	Toilet Compartments	0	3/20/2020
10 26 00	WALL AND DOOR PROTECTION	0	3/20/2020
10 28 00	TOILET, BATH AND LAUNDRY ACCESSORIES	0	3/20/2020
10 43 13	DEFIBRILLATOR CABINETS	0	3/20/2020
10 43 14	AUTOMATED EXTERNAL DEFIBRILLATORS	0	3/20/2020
10 44 13	FIRE PROTECTION CABINETS	0	3/20/2020
10 44 16	FIRE EXTINGUISHERS	0	3/20/2020
10 73 18	PREFABRICATED METAL CANOPIES	0	3/20/2020
10 75 16	GROUND-SET FLAGPOLES	0	3/20/2020
10 81 13	BIRD CONTROL DEVICES	0	3/20/2020
11 12 00	PARKING CONTROL EQUIPMENT	0	3/20/2020
11 31 00	RESIDENTIAL APPLIANCES	0	3/20/2020
11 40 00	Foodservice Equipment	0	3/20/2020
12 24 13	ROLLER WINDOW SHADES	0	3/20/2020
12 36 16	METAL COUNTERTOPS	0	3/20/2020
12 36 61	SIMULATED STONE COUNTERTOPS	0	3/20/2020

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21 05 00	Common Work Results for Fire Suppression	0	3/20/2020
21 05 53	Identification for Fire-Suppression Piping and Equipment	0	3/20/2020
21 13 00	Fire-Suppression Sprinkler Systems	0	3/20/2020
22 05 00	Common Work Results for Plumbing	0	3/20/2020
22 05 13	Common Motor Requirements for Plumbing Equipment	0	3/20/2020
22 05 16	Expansion Fittings and Loops for Plumbing Piping	0	3/20/2020
22 05 19	Meters and Gages for Plumbing Piping	0	3/20/2020
22 05 48	Vibration and Seismic Controls for Plumbing Piping and Equipment	0	3/20/2020
22 05 53	Identification for Plumbing Piping and Equipment	0	3/20/2020
22 07 19	Plumbing Piping Insulation	0	3/20/2020
22 30 00	Plumbing Equipment	0	3/20/2020
22 40 00	Plumbing Fixtures	0	3/20/2020
23 05 00	Common Work Results for HVAC	0	3/20/2020
23 05 13	Common Motor Requirements for HVAC Equipment	0	3/20/2020
23 05 14	Variable Frequency Drives	0	3/20/2020
23 05 29	Hangers and Supports for HVAC Piping and Equipment	0	3/20/2020
23 05 48	Vibration and Seismic Controls for HVAC Piping and Equipment	0	3/20/2020
23 05 93	Testing, Adjusting, and Balancing for HVAC	0	3/20/2020
23 07 00	HVAC Insulation	0	3/20/2020
23 09 13	Instrumentation and Control Devices for HVAC	0	3/20/2020
23 09 23	Direct Digital Control System for HVAC	0	3/20/2020
23 09 93	Sequence of Operation for HVAC Controls	0	3/20/2020
23 31 00	HVAC Ducts and Casings	0	3/20/2020
23 33 00	Air Duct Accessories	0	3/20/2020
23 34 00	HVAC Fans	0	3/20/2020
23 37 13	Diffusers, Registers and Grilles	0	3/20/2020
23 41 00	Particulate Air Filtration	0	3/20/2020
23 55 00	Fuel-Fired Heaters	0	3/20/2020
23 74 13	Packaged Rooftop Units	0	3/20/2020
23 81 27	Small Split-System Heating and Cooling	0	3/20/2020
26 05 00	Common Work Results for Electrical	0	3/20/2020
26 05 19	Low-Voltage Electrical Power Conductors and Cables	0	3/20/2020
26 05 23	Control-Voltage Electrical Power Cables	0	3/20/2020
26 05 26	Grounding and Bonding for Electrical Systems	0	3/20/2020
26 05 29	Hangers and Supports for Electrical Systems	0	3/20/2020
26 05 33	Raceway and Boxes for Electrical Systems	0	3/20/2020
26 05 53	Identification for Electrical Systems	0	3/20/2020
26 05 73	Short Circuit Coordination Study and Arc Flash Hazard Study	0	3/20/2020
26 22 00	Low-Voltage Transformers	0	3/20/2020
26 24 13	Switchboards	0	3/20/2020
26 24 16	Panelboards	0	3/20/2020
26 27 02	Equipment Wiring Systems	0	3/20/2020
26 27 26	Wiring Devices	0	3/20/2020
26 27 28	Disconnect Switches	0	3/20/2020
26 41 00	Facility Lightning Protection	0	3/20/2020
26 43 13	Surge Protective Devices for Low-Voltage Electrical Power Circuits	0	3/20/2020
26 51 13	Interior Lighting Fixtures, Lamps, and Ballasts	0	3/20/2020
26 51 15	Low Voltage Lighting Control	0	3/20/2020
26 56 29	Site Lighting	0	3/20/2020
28 31 00	Fire Detection and Alarm	0	3/20/2020
31 31 16	TERMITE CONTROL	0	3/20/2020
31 1000	Site Clearing	1	3/20/2020
31 2000	Earth Moving	1	3/20/2020
32 14 00	UNIT PAVING	0	3/20/2020
32 15 43	EQUESTRIAN ARENA AGGREGATE SURFACING	0	3/20/2020
32 18 16	EQUINE PROTECTIVE SURFACING SYSTEM	0	3/20/2020

32 31 13	CHAIN LINK FENCES AND GATES	0	3/20/2020
32 31 19	Decorative Metal Fences and Gates	0	3/20/2020
32 40 10	Water Distribution	0	3/20/2020
32 40 20	Sanitary Sewerage	0	3/20/2020
32 40 30	Storm Drainage	0	3/20/2020
32 50 10	Hot-Mix Asphalt Paving	0	3/20/2020
32 50 15	Cement Concrete Paving	0	3/20/2020
32 50 20	Pavement Joint Sealants	0	3/20/2020
32 92 00	Turf and Grasses	0	3/20/2020
32 93 00	Plants	0	3/20/2020

Other Documents to be included:

- **Geotechnical Report (OGR-19152) dated December 2019**
- **Geotechnical Report (OGR-19071) dated July 2019**

Contractor's Checklist for Bid Submittal

Please verify the following has been included in the sealed envelope to be submitted at bid opening by the County Clerk's Office located at the Canadian County Administrative Building (405-295-6125), 201 N. Choctaw, El Reno, OK 73036, Thursday, May 7th no later than 2:30pm central standard time, to be a qualified bid. Bids will not be considered unless these items are fully completed and signed and certified by the Bidder

1. Bid Form – signed
2. Affidavits – signed & notarized
    a. Non-collusion Affidavit
    b. Business Relationship Affidavit
    c. Safety Policy Affidavit
    d. Project Management Affidavit
    e. Hazard Notification
    f. Contract Drawings, Specifications, Reports Package Affidavit

3. Bid Guarantee – Five percent of bid proposal for bids more than $50,000

    NOTE: Each bid must be accompanied by a 5% bid guarantee for the combined amount of Base Bid and all Alternates that total $50,000.00 or more. (No bid guarantee required if the total of the Base Bid and Alternates combined is less than $50,000.00)

    Submit one of the following:
    a. Certified Check
    b. Bid Bond issued by a surety licensed to conduct business in the state of Oklahoma.
    c. In lieu of payment, performance and warranty bonds, bidders may use an Irrevocable Letter of Credit from a federally or Oklahoma financial institution.

4. Schedule of Values – shall outline price breakdown for labor, materials, etc for portions or milestones of the building.
5. In order to expedite contracts please include a W-9 Form, completed.
6. Please check in Building Connected or with Lingo Construction's office to verify any and all Addendums that may have been issued are acknowledged on your Bid Form.

End of Contractor's Checklist for Bid Submittal

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Instructions To Bidders

TABLE OF ARTICLES

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES
§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS
§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the

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Instructions To Bidders

Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

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

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. **Do not send substitution requests directly to the Architect. Substitution requests to be submitted to CM for processing.** Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final. **Substitution request form included in section 00 2200 must be submitted with the substitution request.**

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

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ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by

mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.3.5 Do not add, omit, delete, or modify from the scope of work listed in the bid packages. Doing so may result in the Owner setting the bid aside.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the thirty (30) day period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

If stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Construction Manager, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents. Bidders must demonstrate that they are financially capable of performing work, without disruption, until the first payment application is processed as well as in between payments.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Construction Manager in writing:

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- **.3** names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Construction Manager will notify the Bidder in writing if either the Owner or Architect or Construction Manger, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect and Construction Manager have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

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ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Construction Manager not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN TRADE CONTRACTOR AND CONSTRUCTION MANAGER

§ 8.1 Sample Subcontract Form

§ 8.1.1 Copy attached in section along with accompanying packet outlining payment application process as well as required documents for successful bidders.

ARTICLE 9 SALES TAX

§ 9.1 Sales Tax Exemption Notice

§ 9.1.1 The Owner will designate and appoint the Construction Manager and Trade Contractors involved in the construction of this project as agents for the school district in connection with and solely for the purpose of purchasing materials and intangible property on which a sales tax would normally apply and to be used in the construction of this project, and to inform and instruct said agents of the proper procedure to follow in order to qualify said purchases for the exemptions of sales tax.

§ 9.1.2 A letter stating that they are a designated agent of the school will be issued.

§ 9.1.3 Although the materials and intangible property are being bought on behalf of the school Trade Contractors shall remain responsible for handling, securing, protecting, and replacement cost should that be necessary. Furthermore, any insurance deductibles would remain the responsibility of the trade contractors.

End of Instructions to Bidders

METCO
MIDWEST ENGINEERING & TESTING CORPORATION

ADDITIONAL GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

PROPOSED CANADIAN COUNTY FAIRGROUND PROJECT
S. ALFADALE ROAD AND E. JENSEN ROAD
EL RENO, CANADIAN COUNTY, OKLAHOMA

Prepared for
CANADIAN COUNTY
201 NORTH CHOCTAW ROAD
EL RENO, OKLAHOMA 73036

Prepared by
MIDWEST ENGINEERING AND TESTING CORPORATION
2025 S. NICKLAS, SUITE 115
OKLAHOMA CITY, OKLAHOMA 73128

405-681-6737

METCO PROJECT NO: OGR-19152

DECEMBER 2019

METCO
MIDWEST ENGINEERING AND TESTING CORPORATION

December 20, 2019

Canadian County
201 North Choctaw Road
El Reno, Oklahoma 73036
Phone: 405-295-6000
Fax: 405-422-2429

Attention: Mr. Dave Anderson, Commissioner District 2

Subject: Additional Geotechnical Engineering Services Report
Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma
METCO Previous Project No: OGR-19071
METCO Current Project No: OGR-19152

Dear Mr. Anderson:

Midwest Engineering and Testing Corporation (METCO) is pleased to submit this Additional Geotechnical Engineering Services Report for the above-referenced project. The purpose of our services was to assist the design team in designing foundations and general pavement systems and preparing plans and specifications for construction of the proposed project. Our services were completed in general accordance with the scope of work as outlined in METCO proposal number OGP-19189 dated November 23, 2019. Written authorization was provided by Mr. Dave Anderson, Chairman, of Board of Canadian County Comm. on December 2, 2019. This additional geotechnical engineering services report should be attached to and made a part of the July 19, 2019 geotechnical engineering service report, METCO project No: OGR-19071.

A summary report along with our formal detailed Additional Geotechnical Engineering Services Report is enclosed for your review. **The entire report should be read in its entirety prior to utilizing any of the presented information for design or construction purposes.**

METCO was asked to provide this additional Geotechnical Engineering Services after the building location was moved from the original location. Additionally, METCO was asked to evaluate a potential borrow pit area for select fill. The following presents our findings and conclusions

Executive Summary

A total of 2 additional soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by Canadian County, the borings were drilled within the general vicinity of the proposed new construction areas. These borings were drilled to approximate depths of 20.0 feet to 25.5 feet below existing grade. Location and depth of the borings were selected by Canadian County. Locations of the proposed new construction as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Indications of possible fill soils were not encountered in the borings. **However, fill soils may exist to various depths at other site locations**. Below approximately 3.0 inches of topsoil,

the borings generally encountered soils consisting of clay to approximate depths of 15.5 feet to 21.0 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 10 to 47 blows per foot (bpf) of penetration indicating stiff to hard consistencies in the cohesive soils. Below the upper soils and extending to boring termination depths of approximately 20.0 feet to 25.5 feet below existing grade, the borings encountered soft to moderately hard shale.

Based on laboratory testing, the subsurface tested soils are susceptible to low to moderate swell potential.

Groundwater was encountered in boring B-1, at approximate depths of 23.0 feet below existing grade, at the time of drilling and end of day. Groundwater was not encountered in boring B-2 at the time of drilling and end of day. **However, it is possible that transient saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. It is strongly recommended that the contractor determine the actual groundwater levels prior to construction.**

Summary of Recommendations

In general, we recommend that all structural improvement areas be drained of any surface water, and stripped of topsoil materials, if any, **existing underground and/or overhead utilities, if any existing fill, if any, soft soils, any organic material,** any asphalt, any concrete, any gravel, if any, any old foundations, old underground storage tanks or basements, if any, burn pits, if any, and any other deleterious materials encountered at the time of construction. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the swell/collapse of the upper soils. Following the removal of all unsuitable onsite debris and vegetation and excavation to the proposed subgrade level, the construction area should be proof-rolled with a tandem axle dump truck or similar rubber-tired vehicle. Soils which are observed to rut or deflect excessively under the moving load should be undercut; moisture conditioned and re-compacted in place or replaced with properly compacted fill. **Over excavation of such soils could extend to several feet below the exposed subgrade level.** The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. **After proof-rolling is completed and any soft areas or areas exhibiting rutting or pumping are properly corrected**, the subgrade soils should be scarified and compacted, at -1 percent of the optimum moisture content to +3 percent of the optimum moisture content, to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8-inches below the exposed surface. Fill soils should be placed in 8-inch loose lifts and compacted to at least 95% of maximum dry density as determined by ASTM Designation D 698 at -1 percent of optimum moisture content to +3 percent of the optimum moisture content.

Based on the results obtained from our exploration and analysis, the proposed building can be supported on conventional shallow spread footings **founded on existing non-expansive stiff soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill**. Shallow spread footings for building columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,000 and 1,600 pounds per square foot, respectively at a minimum depth of 24 inches below final grade. **A gravel base may be required depending on the actual soil conditions at the time of construction. Proper**

observation of the footing excavations by METCO representatives is essential for the performance of the structure. Once the final design and grading plans are complete, METCO should be contracted for additional analysis.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

As an alternate foundation system, a drilled pier and grade beam foundation system can be used for support of the column loads and wall loads, respectively. The base of the drilled piers should bear a minimum of 3.0 feet or one pier diameter, **whichever is deeper**, into the rock strata. The rock strata were encountered in the deeper building borings at approximate depths of 15.5 feet to 21.0 feet below existing grade. **However, the rock strata depths may significantly vary across the site**. The drilled piers can be designed for a maximum allowable end bearing pressure of 15,000 psf, based on dead plus design live loads. An allowable skin friction of 1,500 psf can be utilized for that portion of the pier extending more than 3 feet or one pier diameter, whichever is deeper, into the rock strata. **The bearing strata depths should be verified prior to construction. Difficulties might be encountered during drilling due to the nature of the subsurface formation. Additional drilling should be performed prior to final design and construction. The drilled piers should be at least 3 pier diameters deep.**

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

The weathering process of shale is erratic and variations in the shale profiles can be expected in small lateral distances.

It should be noted that TCP results in the bore holes ranged from 2.5 inch for 100 blows to 6.8 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

The piers should be reinforced for their full depth with reinforcing steel. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the soils based on soil adhesion of 900 psf over the upper 10 feet of the pier shaft. Soft or loose soil encountered at the bearing level should be removed. All loosened soils should also be removed. If personnel entry into the shaft is required, a 30-inch minimum diameter is recommended.

A slump of 5 to 7 inches is desired to reduce the potential for forming of voids as the casing is extracted and groundwater related problems. Foundation excavations should be filled with concrete as soon as possible to reduce the potential of groundwater related problems. **To reduce difficulties associated with sloughing and/or groundwater related problems and to facilitate observation, the use of temporary casing might be required.**

Grade beams can be supported on a minimum of 6-inch void space between the bottom of the beams and the underlying soils. Cardboard forms can be used to provide the required void space. Care must be taken to maintain the integrity of the cardboard boxes up to the time the concrete is placed. Wet, damaged, or poorly constructed void boxes may collapse under the weight of the concrete.

The floor slab can be grade supported on existing (to be verified during construction) non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested, non-expansive structural fill materials. Proof rolling, as discussed in this report, should be accomplished to identify any soft or unstable soils, which should be removed from the floor slab area prior to new fill placement and/or floor slab construction.

It is recommended that free draining granular mat be placed beneath the floor slab to enhance drainage and provide increased subgrade strength. Polyethylene sheeting should be placed on the granular mat to act as a vapor barrier. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage. The floor slab should not be rigidly connected to columns, walls, or foundations, if possible. **Detailed floor slab recommendations are presented in section 5.5 of this report.**

Although fill material was not observed in the borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction areas. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted and tested low plasticity structural fill.**

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The scope of services did not include an environmental site assessment for determining the presence or absence of toxic or hazardous materials in the soil, surface water, groundwater, or air on, below, or around the site. Any statements regarding colors, odors, suspicious, or unusual items are strictly for informational purposes. Prior to further development of this site, an environmental assessment is advisable.

General

The attached entire report should be read and the contents evaluated prior to utilizing our recommendations in the preparation of the design and construction documents. Please refer to the attached report for a more detailed summary of our analysis and recommendations. It is recommended that METCO be retained to provide observation and testing services during construction. Please do not hesitate to contact our office at 405-681-6737.

Respectfully Submitted,

Midwest Engineering and Testing Corporation
CA No. 4198, Expires 06/30/2021

Shafe Saad Aldin, E.I.
Engineer Intern

Nasir Marakah, P.E.
President

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Additional Geotechnical Engineering Services Report
Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma
METCO Project No: OGR-19152
December 2019

1.0 Introduction

Midwest Engineering and Testing Corporation (METCO) has completed additional geotechnical exploration and evaluation of the subsurface conditions for the above-referenced project site in general accordance with the scope of work as outlined in METCO proposal number OGP-19189 dated November 23, 2019. Written authorization was provided by Mr. Dave Anderson, Chairman, of Board of Canadian County Comm. on December 2, 2019.

2.0 Project Description

Based on project information provided, we understand the proposed construction will consist of the following:

Building	New Single-Story Building Without a Basements Ground Supported Floor Slabs Less than 60 Kip Column Loads, 3.0 KLF Continuous Loads
Grading	Less Than 2 Feet of Cut/ Fill, Each at The Proposed Building Areas
Pavement	Asphaltic Concrete and/or Rigid Pavement

Once the final grading plans are available, METCO should be contracted for additional analysis. Modifications to the presented recommendations may be warranted and should be expected based on the final grading plans. Ground elevations at the boring locations should be determined by others prior to any grading activities.

If potential settlements cannot be tolerated, crushed stone should be used to backfill and deep fill areas to within 5 feet of final grade.

If some settlements can be tolerated, material such as GW, GM, SW, SM and SC with a plasticity index (PI) of 9 or less should be used to backfill any deep fill areas to approximately 5.0 feet below final grade. Select fill should be placed in loose 6-inch lifts and should be compacted, at 1 percent below optimum to 3 percent above the optimum moisture content, to 98 percent of the modified Proctor maximum dry density ASTM D1557. Any placed fill should be monitored prior to and during construction.

It should be noted that these stricter requirements only apply for deep fill areas (over 5 feet).

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavations or on prepared subgrade of the construction areas either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

If the groundwater levels are expected to be near the expected excavation levels in the proposed construction areas, dewatering prior to and after construction will be required. The design engineer should consider the effects of groundwater. A comprehensive drainage system should be designed to prevent the damages to the proposed structure, if deemed necessary by the design engineer.

It should be noted that TCP results in the bore holes ranged from 2.5 inch for 100 blows to 6.8 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

The location of the site is shown on the Site location Map.

3.0 Scope of Work

The purpose of this exploration and evaluation was to assess the subsurface soil conditions at the project site, at the boring locations, in order to help in the evaluation of acceptable foundation and general pavement systems for the proposed project.

Our scope of services included the items presented in the following sections.

3.1 Subsurface Exploration

A total of 2 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by Canadian County, the borings were drilled within the general vicinity of the proposed new construction areas. These borings were drilled to approximate depths of 20.0 feet to 25.5 feet below existing grade. Location and depth of the borings were selected by Canadian County. Locations of the proposed new construction as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Soil samples were taken at regular intervals during the drilling process. Samples were identified in the field, placed in sealed plastic bags, and transported to the laboratory for further classification and testing.

When the split spoon sampler was used, Standard Penetration Tests (SPT's) were performed at regular intervals in general accordance with ASTM Designation D1586, samples collected, and results presented on the boring logs. The SPT used in soil borings is performed by driving a 2-inch, O.D., split-spoon sampler into the undisturbed formation located at the bottom of the advanced auger with repeated blows of a 140-pound, pin-guided, hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler one foot is a measure of the soil consistency.

When the Texas Cone Penetration test was used to evaluate the bedrock, the cone was driven into the bedrock material with a 140-pound automatic hammer that falls 30 inches. After the cone was seated, the distance the TCP is driven was recorded after each of two 50 blow counts.

3.2 Laboratory Evaluation

Selected samples of the subsurface soils were tested in the laboratory to determine materials properties for further evaluation and approximate unified soil classifications were determined by

visual inspection. The laboratory evaluation consisted of visual and textural examinations, moisture content, Atterberg limit tests and percent passing the No. 200 sieve. Additionally, proctor tests, pH tests and soluble sulfate tests were performed on representative samples. Results of the tests are shown on the attached logs of borings and in the appendix.

3.3 Engineering Analysis

Engineering analysis and recommendations regarding general foundation design including allowable soil bearing pressures, minimum depth requirements, and estimates of foundation settlement are included in this report. In addition, recommendations were developed addressing site preparation, placement and compaction of fill materials, and site preparation of the floor slab areas.

This geotechnical engineering report presents recommendations derived from existing and available information pertaining to the proposed project; relevant laboratory data, information, and test results; subsurface materials encountered in our borings, and the proposed new construction locations. The attached entire report should be read and the contents evaluated so that to facilitate any changes that may be desired. If any changes or corrections are desired, please inform METCO in writing so that we may amend the presented recommendations.

METCO cannot be responsible for the interpretation or implementation of this report by others. METCO should be retained to provide observation and testing during construction. Foundations, earthwork, and all other construction related activities should be observed by METCO. METCO will not accept any responsibility for the performance of the subgrade, foundations, any structure or pavement for this project nor will it accept any responsibility for any conditions which deviated from those described in this report.

4.0 Surface and Subsurface Features

4.1 Site Description

The subject property is approximately located at the northwest corner of the intersection of S. Alfadale Road and E. Jensen Road in El Reno, Canadian County, Oklahoma. The proposed construction area was covered with grass and visually appeared to be relatively level with a gentle slope to the south and southwest. Some utilities and buildings existed in the general vicinity of the proposed construction areas. The surface conditions were relatively dry and our truck-mounted drill rig experienced no difficulty in moving around the site.

4.2 Soil Subsurface Conditions

Indications of possible fill soils were not encountered in the borings. **However, fill soils may exist to various depths at other site locations**. Below approximately 3.0 inches of topsoil, the borings generally encountered soils consisting of clay to approximate depths of 15.5 feet to 21.0 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 10 to 47 blows per foot (bpf) of penetration indicating stiff to hard consistencies in the cohesive soils. Below the upper soils and extending to boring termination depths of approximately 20.0 feet to 25.5 feet below existing grade, the borings encountered soft to moderately hard shale.

Laboratory tests indicated that the site soils had plasticity indices ranging from 6 to 22 and grain size distribution tests show that the tested soils contain about 84 to 96 percent fines (that material passing a No. 200 mesh sieve). The encountered soils were classified as CL and CL-ML in accordance with the Unified Soil Classification System.

Laboratory tests in the test pit area indicated that the site soils had plasticity indices ranging from 24 to 25 and grain size distribution tests show that the tested soils contain about 85 to 89 percent fines (that material passing a No. 200 mesh sieve). The encountered soils were classified as CL in accordance with the Unified Soil Classification System

The pH of the tested soil ranged from 5.9 to 6.8. This limited pH testing should not be interpreted as a comprehensive assessment of the site, but only provides an indication of the tested locations. Results of these tests are presented in the table below.

Soluble sulfate results ranged from less than 200 ppm to 480 ppm are reported for the tested samples presented in the table below. This limited total soluble sulfate testing should not be interpreted as a comprehensive assessment of the site, but only provides an indication of the tested locations. Results of these tests are presented in the table below:

Sample No.	Sample Depth (feet)	pH	Sulfate Concentration (ppm)
Test Pit	Composite @ 0.0-2.5	6.1	480
Test Pit	Composite @ 2.5-5.0	6.5	<200
B-1	Composite @ 1.0	6.8	<200
B-2	Composite @ 1.0	5.9	<200

Moisture density relationship tests performed on composite subgrade soils obtained from the test pit indicated maximum dry densities in the range of 100.2 pcf to 102.3 pcf with optimum moisture contents in the range of 17.5% to 22.50%. The results are presented in the Appendix.

Based on the results of our laboratory-tests and our experience with other sites in the general vicinity, the on-site tested soils are susceptible to low to moderate swell potential. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the collapse/swell of the upper soils.

Although fill material was not observed in the borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction areas. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted and tested low plasticity structural fill.**

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The above description of the subsurface conditions constitutes a generalization that emphasizes the subsurface stratification features and characteristics. The data and information at the specific boring locations are recorded in the boring logs. These logs present a description of subsurface soil and rock, applicable laboratory and field test results, sample location, and general stratification. Variations in the stratification presented in the boring logs should be expected across the site and between boring locations as the presented strata description is only indicative of the boring locations.

4.3 Groundwater

Groundwater was encountered in boring B-1, at approximate depths of 23.0 feet below existing grade, at the time of drilling and end of day. Groundwater was not encountered in boring B-2 at the time of drilling and end of day. **However, it is possible that transient saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. It is strongly recommended that the contractor determine the actual groundwater levels prior to construction.**

4.4 Seismic Considerations

IBC Seismic Zone Coefficients

Earthquake related design parameters may be obtained from the International Building Code 2015 Edition, using *a Site Class **C** Definition.*

If site-specific earthquake response spectra or other specific design parameters are deemed necessary by the project structural engineer, or are required by the local governmental agency who has jurisdiction over the project, the geotechnical engineer should be promptly informed so that the appropriate analysis can be performed. In addition, design of structures should comply with the requirements of the governing jurisdiction's building codes and standard practices of Oklahoma.

5.0 Evaluation and Recommendations

Based on the results of our fieldwork, laboratory evaluation, and engineering analysis, the proposed building can be supported on shallow spread footings **founded on exiting stiff non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill** at a minimum depth of 2.0 feet below final grade.

As an alternate foundation system, the proposed building can be supported on a drilled pier foundation system bearing a minimum of 3.0 feet or one pier diameter, whichever is deeper, in the rock strata. Other types of foundation systems can be evaluated, if desired.

Once the final grading plans are available, METCO should be contracted for additional analysis. Modifications to the presented recommendations may be warranted and should be expected based on the final grading plans. Ground elevations at the boring locations should be determined by others prior to any grading activities.

If potential settlements cannot be tolerated, crushed stone should be used to backfill and deep fill areas to within 5 feet of final grade.

If some settlements can be tolerated, material such as GW, GM, SW, SM and SC with a plasticity index (PI) of 9 or less should be used to backfill any deep fill areas to approximately 5.0 feet below final grade. Select fill should be placed in loose 6-inch lifts and should be compacted, at 1 percent below optimum to 3 percent above the optimum moisture content, to 98 percent of the modified Proctor maximum dry density ASTM D1557. Any placed fill should be monitored prior to and during construction.

It should be noted that these stricter requirements only apply for deep fill areas (over 5 feet).

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction areas either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

If the groundwater levels are expected to be near the expected excavation levels in the proposed construction areas, dewatering prior to and after construction will be required. The design engineer should consider the effects of groundwater. A comprehensive drainage system should be designed to prevent the damages to the proposed structure, if deemed necessary by the design engineer.

It should be noted that TCP results in the bore holes ranged from 2.5 inches for 100 blows to 6.8 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

Generally, similar structures as that proposed are designed for post-construction vertical slab movements of less than 1 inch. Consideration must be given to the presence of moderately plastic clays within the proposed construction areas. These soils may exhibit significant volumetric changes with changes in their moisture content. We estimate the potential vertical rise (PVR) to be on the order of 2.3 inches. These movements are based on the worst-case dry soil conditions. It was estimated that the PVR for a floor slab supported on a minimum of 3.0 feet of low plasticity structural fill to be on the order of less than 1 inch.

5.1 Site Preparation

Typically, it is recommended that prior to general site grading, **all topsoil, any existing fill material, any organic material, any underground utilities and/or overhead utilities,** existing concrete, if any, asphalt, gravel, any old foundations, any old underground storage tanks, if any if any, and any other deleterious materials encountered at the time of construction **and soft soils** should be stripped from the proposed construction area. The depth of required removal should be evaluated by a representative of the geotechnical engineer at the time of construction. The resulting excavations should be widened, as necessary, to allow access to compaction equipment. **The site was cleared prior to our field activities.**

Once the proposed subgrade level has been exposed, the construction area should be proof-rolled during a period of dry weather. **A representative of the geotechnical engineer should observe the exposed subgrade for soils that rut or deflect under the moving load.** Such soils should be recompacted or replaced with properly compacted fill. **Over excavation of such soils could extend to several feet below the exposed subgrade level. Stabilization of the subgrade soils and/or a gravel base may be required depending on the actual soil conditions at the time of construction. After proof-rolling is completed and any soft**

areas or areas exhibiting rutting or pumping are properly corrected, the top 8 inches of the exposed subgrade should be scarified; moisture conditioned, if necessary, and compacted, at 1 percent below the optimum moisture content to +3 percent of optimum moisture content, to 95 percent of the standard Proctor maximum dry density ASTM D698.

Any fill should have a liquid limit of 35 or less and a plasticity index of 5 to 15, be 3 inches or less in particle size, and should be free of organic or any deleterious materials. Fill should be placed in loose 8-inch lifts and should be compacted at 1 percent below optimum to 3 percent above the optimum moisture content. The first layer of fill material should be placed in a relatively uniform horizontal lift and be keyed into the prepared subgrade soils.

Based on the laboratory test results, most of the on-site tested soils are not-suitable for use as structural fill. However, these soils should be tested in bulk at the time of construction. If a fine-grained clay soil is used for fill, close moisture content control will be required to achieve the recommended degree of compaction. If water is added, it should be uniformly applied and thoroughly mixed into the soil. Structural fill should be compacted to at least 95 percent of standard Proctor maximum dry density as determined by ASTM Designation D 698.

It should be noted that the on-site soils can be modified to be used as structural fill. It is estimated that 4 percent hydrated lime will be adequate to modify the existing soil to be used as structural fill. It is recommended to verify the required percentages at the time of construction.

It is recommended that each compacted-engineered lift be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. It is also recommended that the compacted fill be extended 5 feet beyond the edges of the construction.

5.2 Foundation Support

Based on the results obtained from our exploration and analysis, the proposed structures can be supported on conventional shallow foundation systems. Shallow spread footings for building columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,000 and 1,600 pounds per square foot, respectively, **bearing on existing stiff non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill at a minimum depth of 24 inches below final grade.** To reduce the possibility of local bearing capacity failure, minimum dimensions of 24 inches for column footings and 18 inches for continuous footings should be used in foundation design. The footings should be provided with appropriate reinforcement as determined by the structural engineer. **Proper observation of the footing excavations by METCO representatives is essential for the performance of the structure. Once the final design and grading plans are complete, METCO should be contracted for additional analysis.**

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

A one third increase in bearing value can be used for wind and seismic load considerations. Since the recommended bearing value is a net value, the weight of the concrete in the footings may be assumed to be 50 pounds per square foot. The weight of the soil backfill may be neglected for downward load contribution.

A representative of METCO should observe the foundation excavations prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. **Soft or loose soil zones encountered at the bottom of the footing, excavations should be removed to the level of stiff or dense soil as directed by the geotechnical engineer.** Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with engineered fill, as determined by the geotechnical engineer. METCO should be contacted to evaluate moisture issues, if needed.

An ultimate coefficient of friction of 0.47 can be used between the base of footings and the floor slab and the supporting soils to resist lateral loads. In addition, lateral loads can be resisted by a uniform ultimate passive key resistance of 130 pounds per square foot, for keys embedded at least 2.0 feet below final grade. A one third increase in the passive value can be used for wind and seismic loads. The frictional resistance and the passive resistance of the soils can be combined without any reductions in determining the total lateral resistance.

We estimate that foundations designed and constructed in accordance with the above recommendations will experience total settlements generally less than 1-inch with differential settlements generally less than ¾ inches within the building area. **It should be noted that additional settlements of approximately 1 to 2 percent of placed fill height should be accounted for in the design.** Consolidation testing was beyond the scope of this exploration.

5.3 Alternate Foundation System

As an alternate foundation system, a drilled pier and grade beam foundation system can be used for support of the column loads and wall loads, respectively. The base of the drilled piers should bear a minimum of 3.0 feet or one pier diameter, **whichever is deeper**, into the rock strata. The rock strata were encountered in the deeper building borings at approximate depths of 15.5 feet to 21.0 feet below existing grade. However, **the rock strata depths may significantly vary at other site locations**. The drilled piers can be designed for a maximum allowable end bearing pressure of 15,000 psf, based on dead plus design live loads. An allowable skin friction of 1,500 psf can be utilized for that portion of the pier extending more than 3 feet or one pier diameter, whichever is deeper, into the rock strata. **The bearing strata depths should be verified prior to construction. Difficulties might be encountered during drilling due to the nature of the subsurface formation. Additional drilling should be performed prior to final design and construction. The drilled piers should be at least 3 pier diameters deep.**

The weathering process of shale is erratic and variations in the shale profiles can be expected in small lateral distances.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

The piers should be reinforced for their full depth with reinforcing steel. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the soils based on soil adhesion of 900 psf over the upper 10 feet of the pier shaft.

Soft or loose soil encountered at the bearing level should be removed. All loosened soils should also be removed. If personnel entry into the shaft is required, a 30-inch minimum diameter is recommended.

Pier excavations should be observed by a representative of the geotechnical engineer to assess that the foundation soils have adequate strength to support the design loads and are consistent with the soil encountered in our borings. **To reduce difficulties associated with sloughing and/or groundwater related problems and to facilitate observation, the use of temporary casing might be required.**

A slump of 5 to 7 inches is desired to reduce the potential for forming of voids as the casing is extracted. Foundation excavations should be filled with concrete as soon as possible to reduce the potential of groundwater related problems.

Installation of a test pier during the design stage can be beneficial. The installation of a test pier can aid in the evaluation of potential difficulties that might occur during construction and in verifying the depth of the bearing formations.

5.4 Grade Beams

Grade beams can be supported on a minimum of 6-inch void space between the bottom of the beams and the underlying soils. Cardboard forms can be used to provide the required void space. Care must be taken to maintain the integrity of the cardboard boxes up to the time the concrete is placed. Wet, damaged, or poorly constructed void boxes may collapse under the weight of the concrete. It is recommended that suitable rigid protection be installed along the outer and inner edges of the grade beams to prevent backfill material from collecting in the void space beneath the grade beams.

5.5 Floor Slab Recommendations

Floors slabs can be grade supported on existing (to be verified during construction) non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested, non-expansive structural fill materials. **Floor slabs should be supported directly by 4.0 inches to 6.0 inches of Aggregate Base Course (ABC); over 32.0 inches to 30.0 inches, respectively of non-expansive soil meeting the requirements outlined above**. This material will act as a leveling base and aid in concrete curing. This material will not act as a positive moisture break to prevent moisture rise to the slab. If the floor covering is considered moisture sensitive, plastic sheeting should be placed over the base course. **Any existing fill should be removed prior to fill placement and/or floor slab construction.**

A modulus of subgrade reaction (k) of 100 pounds per cubic inch is recommended for floor slabs overlying the graded gravel base and a compacted subgrade. The floor slabs should have an adequate number of joints to reduce cracking resulting from possible differential movements. The floor slabs should not be rigidly connected to columns, walls, or foundations, if possible. **Floor slab design is not typically the area of expertise of the Geotechnical Engineer and should be verified by the Structural Engineer of Record.**

All construction activity may cause damage and deterioration to the prepared subgrade. We recommend our field representative observe the final subgrade prior to placement of the slab on grade, and perform further testing as necessary.

5.6 Pavement Recommendations

We have assumed typical area soil parameters for pavement design. Our study did not include CBR testing or detailed pavement analysis for the subgrade soils or imported soils. A more detailed analysis of the subgrade and traffic conditions should be made in large areas of pavement, or where pavements are subject to significant traffic. The results of such analysis will provide the needed information for the design of an economical and serviceable pavement. **The project civil engineer should design the actual pavements based on site-specific traffic information.**

The pavement thicknesses presented in the table below are considered area typical and minimum for the assumed parameters. **Thinner pavement sections than those presented in the table might be warranted due to budgetary considerations**. However, Canadian County, and all parties involved should be aware that increased maintenance costs and lower pavement life might be expected with thinner pavement sections. The subgrade should be prepared as recommended in this report.

With an assumed CBR value of 3, a typical standard pavement section consisting of the following could be used:

Asphalt Concrete Flexible Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways
Asphaltic Surface Course	2"	2"
Asphaltic Binder Course	3"	5"
Crushed Stone Base	8"	8"
Concrete Rigid Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways, trash dumpsters area, areas of large loads from small steel wheels
Concrete Pavement	5"	7"
Crushed Stone Base	8"	8"

Providing the proper pavement type and thickness will result in better distribution of surface loads to the subgrade without causing deformation of the surface. Proper compaction, fine grading and proof-rolling should precede pavement placement. The work should be done in accordance with Oklahoma State Department of Transportation guidelines or other applicable guidelines.

The base stone should not get saturated and water should not be allowed to pond behind curbs. To allow water entering the base stone a path to exit, base stone should extend through the slope in down grade areas.

The pavement concrete should have a compressive strength of at least 3,500 psi with 3% to 6% air entrainment. This concrete should be saw-cut as directed by the design engineer. The

pavement should be adequately reinforced with steel. As minimum, the reinforcement steel should be No. 3 bars on a maximum spacing of 18 inches each way. The final pavement section should be designed by the Civil Engineer.

5.7 Lime/ Fly Ash Stabilization

Consideration should be given to lime/fly ash stabilization to improve the parking and driveway subgrade soils. Stabilizing the top 8 inches of the subgrade soil in the parking and driveway areas, will improve the subgrade soils. **The actual lime/fly ash percentage should be determined at the time of construction.**

Sulfate tests and other appropriate tests should be performed prior to the final selection of the stabilizing material.

5.8 Drainage Considerations

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction area either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, or positive run-off. The contractor should exercise care in creating drainage paths for water during the construction phase of the project. Curbing adjacent to landscaped areas should be designed deep enough to act as a barrier between the landscape irrigation and the subgrade soil. Surface run-off from roofs, parking areas, etc., should be discharged away from the structures. To reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs, positive drainage should be provided. If groundwater issues are encountered during construction, METCO should be contacted.

5.9 Excavation and Temporary Slopes

The contractor, designated as "responsible person" in OSHA Construction Standards for Excavations, 29 CFR Part 1926, is solely responsible for planning and implementing all safety procedures. All excavation height, slope, and depth must adhere to all specifications outlined in local, state, and federal safety regulations.

METCO does not assume any responsibility for construction site safety or any party's, including the contractor, compliance with the applicable local, state, and federal safety regulations or any other applicable regulations.

5.10 Trench Backfill

All required trench backfill should be mechanically compacted in layers to at least 95% of the standard Proctor maximum dry density as determined by ASTM Designation D 698. Some settlement of the backfill may be expected and any utilities within the trenches or concrete walks supported on the trench backfill should be designed to accept these differential movements.

5.11 Weather Considerations

The upper soils encountered at this site may be sensitive to moisture variations and construction traffic disturbances during wet weather. The soil strength is significantly reduced when the soil is wet and significant delays in the grading and compaction activities can take place. Thus, it is advantageous to perform construction activities during periods of dry weather.

5.12 Construction Monitoring

METCO should be retained to provide observations and testing of soil exposures created during project construction in order to verify that soil conditions are as anticipated and are as encountered in our borings. Construction activities pertaining to earthwork, foundations, and all other related activities should also be observed by METCO representatives. METCO cannot accept any responsibility for the performance of the subgrade, foundations, any structure or pavement for this project. Furthermore, METCO cannot accept any responsibility for conditions which deviated from those described in this report.

6.0 General

The conclusions and recommendations presented in this report are subject to the following general conditions:

6.1 Use of Report

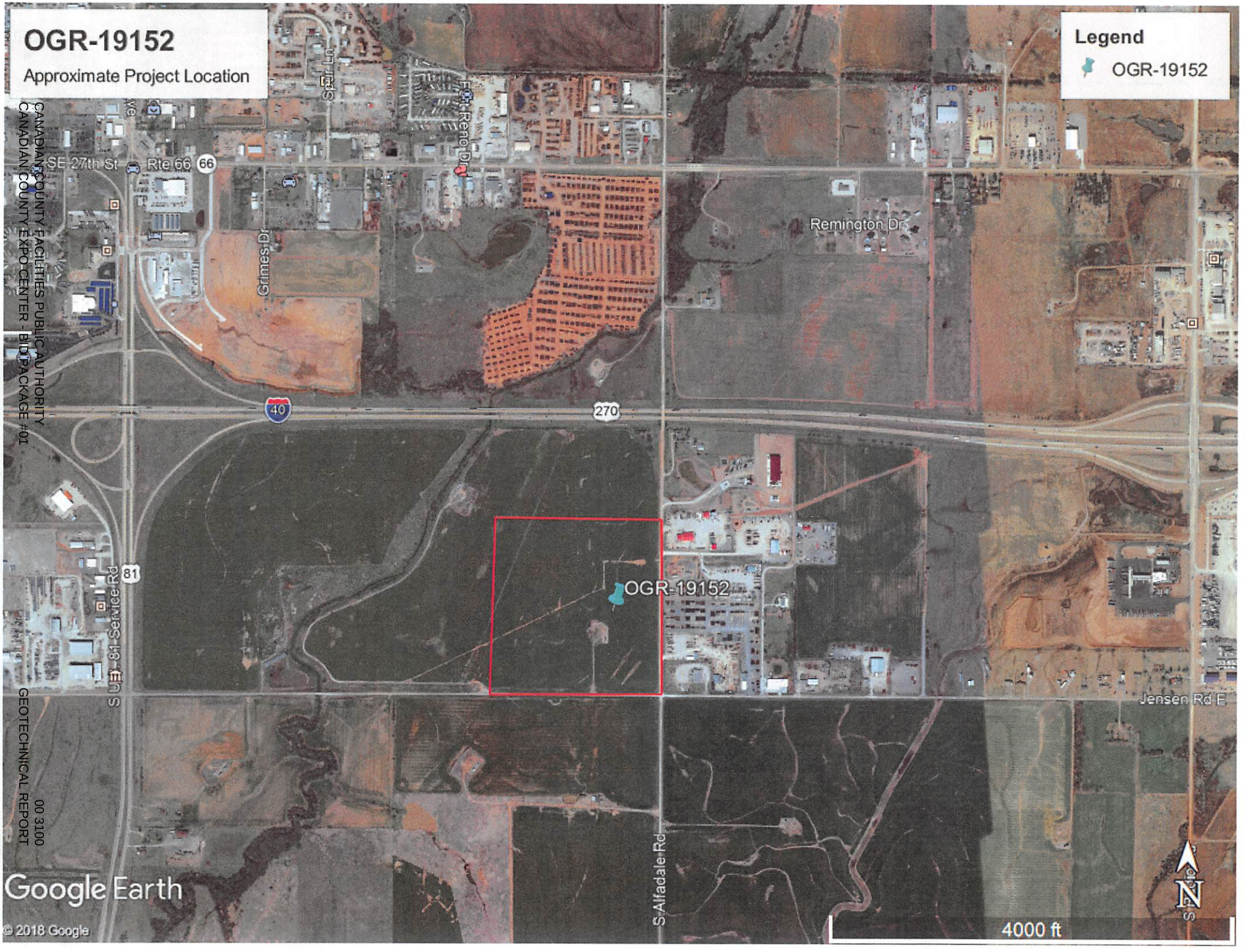
This report has been prepared for the exclusive use of Canadian County, for the specific application for the Proposed Canadian County Fairground Project, located at the northwest corner of S. Alfadale Road and E. Jensen Road in El Reno, Canadian County, Oklahoma. This report should not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us. Unless our written approval is provided, we make no representation and assume no responsibility to other parties regarding this report.

6.2 Level of Care

The recommendations contained in this report are based on the available subsurface information obtained by METCO, and design details furnished for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, METCO should be notified immediately to determine if changes in the foundation recommendations are required. If METCO is not retained to perform these functions, METCO will not be responsible for the impact of those conditions on the project.

Services performed by the geotechnical engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. **No warranty, expressed or implied, is made**.

APPENDIX



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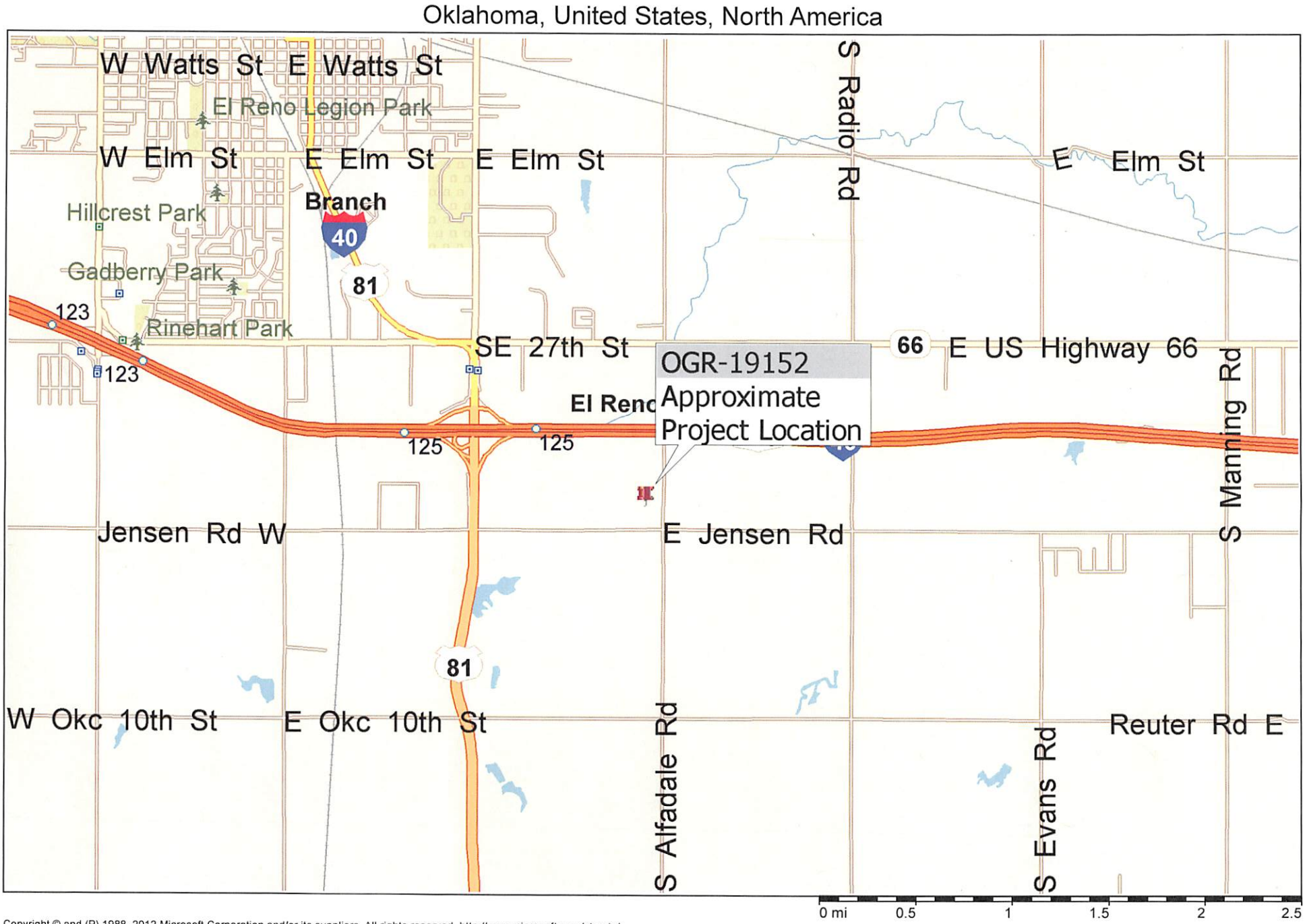
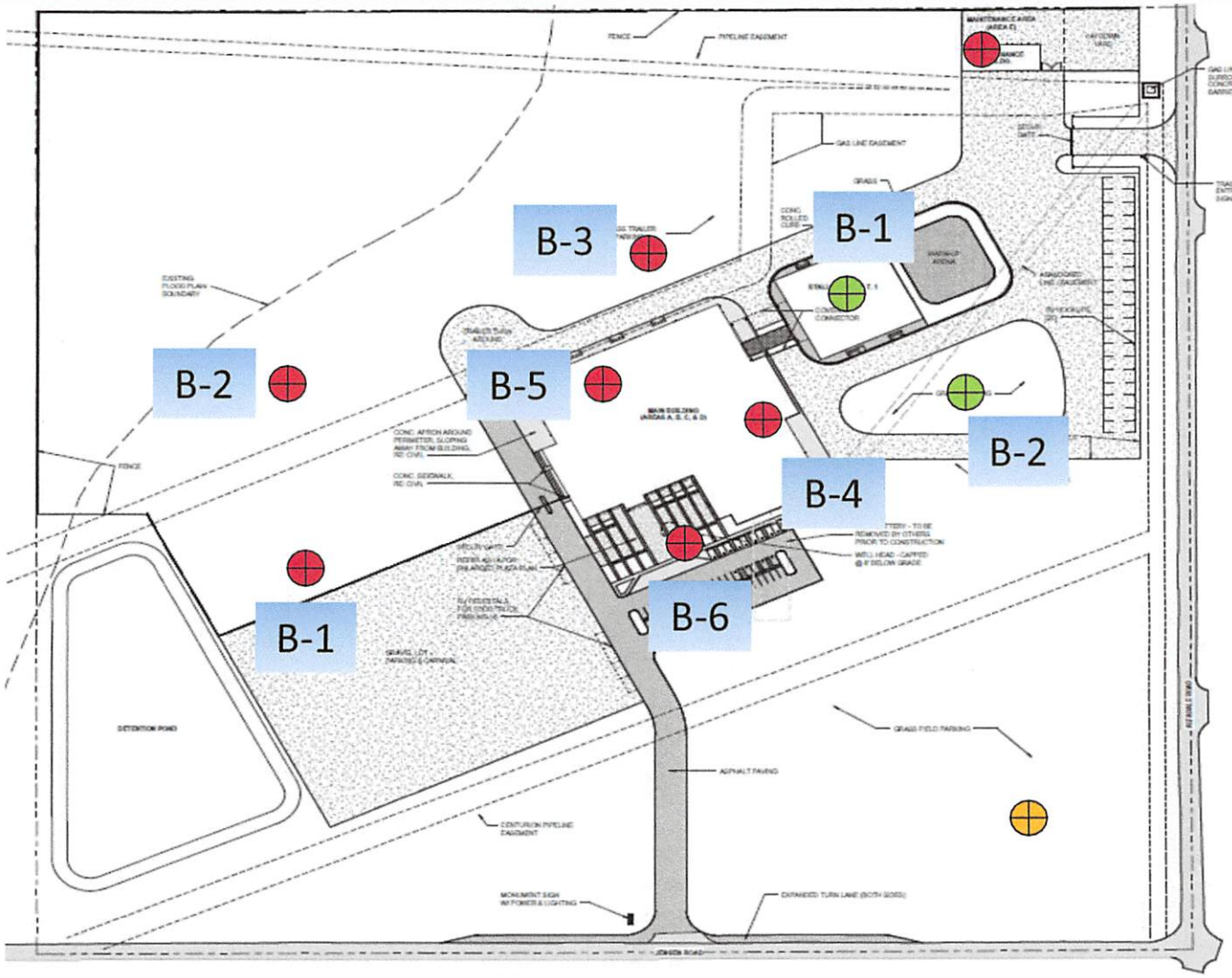
GEOTECHNICAL REPORT





OGR-19071 Approx. Boring Location

OGR-19152 Approx. Boring Location

Approx. Test Pit Location

N

PLAN OF BORINGS

Proposed Canadian County Fairgrounds
Jensen Road and Alfadale Road
El Reno, Oklahoma

METCO JOB#: OGR-19152 | **FIGURE 1**

METCO

LOG OF BORING B-1

PROJECT: Proposed Canadian County Fairgrounds, Jensen Road and Alfadale Road, El Reno, Oklahoma Project No.: OGR-19152

Date Drilled: 12/6/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: 23' Depth To Water On: End of Day Was: 23'

Drilled By: Hector Logger: Stephen Approximate Completion Depth: 25.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		2/6" 3/6" 7/6"	3.0" Topsoil Dark gray lean Clay with sand, stiff to very stiff (CL)	16	26	16	10	84		
4		7/6" 11/6" 11/6"	Reddish brown lean Clay with calcareous inclusions, very stiff (CL)	11	36	17	19	88		
6		6/6" 9/6" 11/6"		11	33	15	18	93		
8		6/6" 9/6" 17/6"	Reddish brown lean Clay with iron stains, very stiff to hard (CL)	15						
11		6/6" 17/6" 22/6"		18	41	26	15	96		
16		7/6" 18/6" 27/6"		15						
21		8/6" 19/6" 50/5"		15	40	22	18	95		
22			Reddish brown Shale, soft							
25		100/6.8"	TC @ 25.0' : 50/5.0", 50/1.8"							

NOTES:

LOG OF BORING B-2

PROJECT: Proposed Canadian County Fairgrounds, Jensen Road and Alfadale Road, El Reno, Oklahoma — Project No.: OGR-19152

Date Drilled: 12/6/2019 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

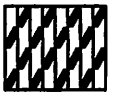
Drilled By: Hector — Logger: Stephen — Approximate Completion Depth: 20.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1–3		5/6" 7/6" 8/6"	3.0" Topsoil Dark gray silty Clay with sand and roots, stiff to very stiff (CL-ML)	11	24	18	6	85		
4–5		8/6" 12/6" 15/6"	Dark gray lean Clay with roots, very stiff to hard (CL)	12	37	18	19	89		
6–7		12/6" 19/6" 18/6"	Brown to light reddish brown lean Clay, hard to very stiff (CL)	10	38	16	22	86		
8–10		7/6" 10/6" 13/6"	Reddish brown lean Clay with iron stains and calcareous inclusions, very stiff to hard (CL)	16	44	22	22	95		
11–15		2/6" 17/6" 30/6"	Reddish brown lean Clay with iron stains, hard (CL)	14	37	20	17	96		
16–20		3/6" 50/6" 100/2.5"	Reddish brown Shale, soft to moderately hard TC @ 20.0' : 50/2.0", 50/0.5"	16 15	39	20	19	97		
21–30										

NOTES:

KEY TO SYMBOLS & PATTERNS USED ON BORING LOGS

Lean Clay



Silty Clay

Shale

Standard
Penetration
Test

Bag Sample

Texas Cone Penetrometer
Test

ABBREVIATIONS USED

MC, %	Moisture Content expressed in percentage
LL	Liquid Limit
PI	Plasticity Index
DD, PCF	Dry Density expressed in pounds per cubic feet
-#200, %	Soil Fraction Passing No. 200 Sieve expressed in percentage
swell, %	Free swell under overburden pressure expressed in percentage
PP, TSF	Pocket Penetrometer Reading expressed in tons per square feet

METCO

FIGURE 4

SUMMARY OF TESTS

Project Name: Proposed Canadian County Fairgrounds, Jensen Road and Alfadale Road, El Reno, Canadian County, Oklahoma

METCO Project No: OGR-19152 Date: 12/16/2019

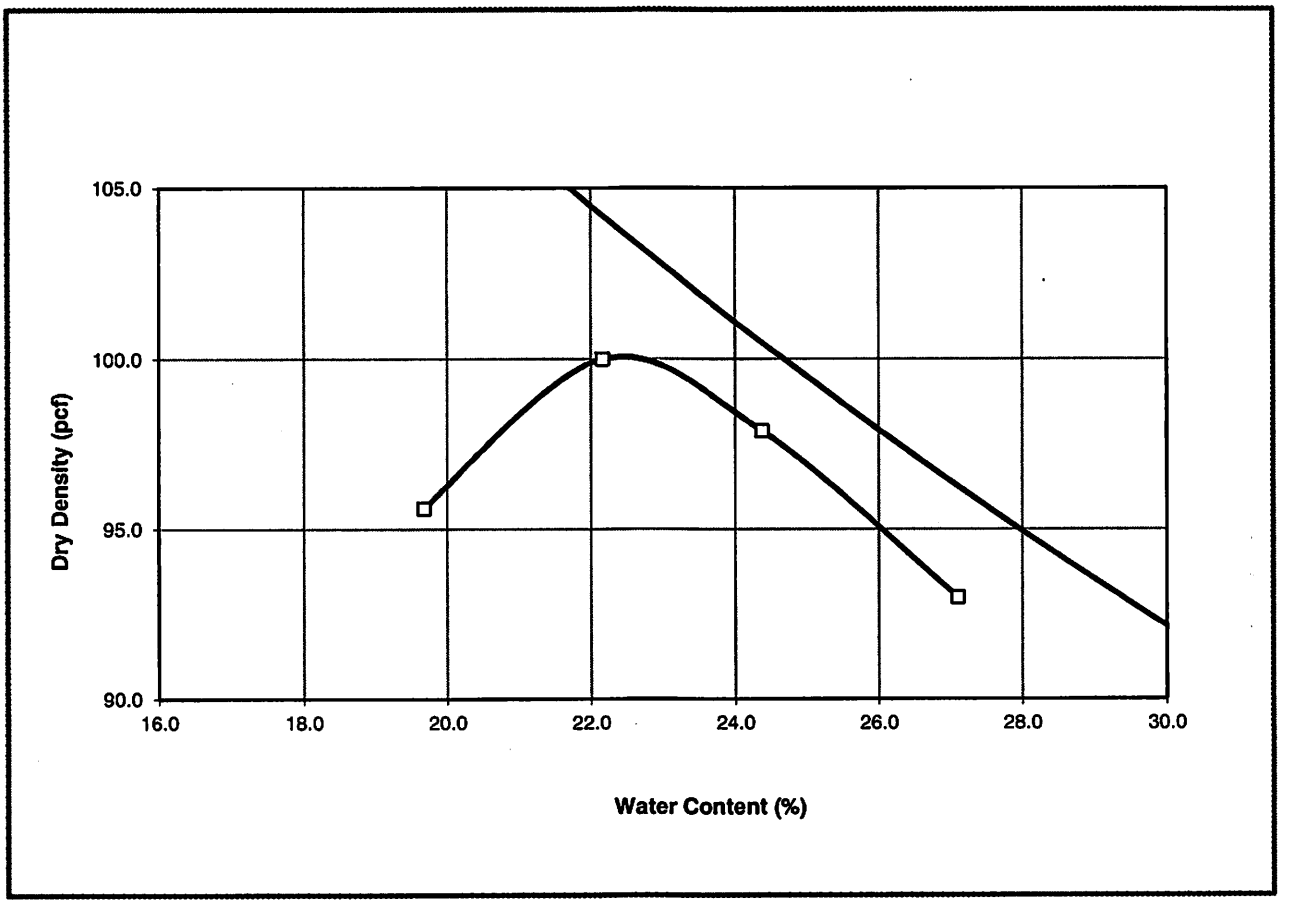
IDENTIFICATION				SOIL SURVEY			PHYSICAL & MECHANICAL ANALYSIS										
Sample Location	SAMPLE DEPTH (Ft)	Maximaum Dry Density (pcf)	Optimum Moisture Content %	N Blows/Ft	TCP inch/100 Blows	SOIL/ROCK DESCRIPTION	LL	PL	PI	M%	Sieve Analysis #10	Sieve Analysis #40	Sieve Analysis #200	AASHTO	USCS	SULFATE CONCENTRATION (PPM)	PH
Test Pit	0.0-2.5	100.2	22.5	-	-	Lean Clay with sand	46	21	25	14	100	100	85	A-7-6 (22)	CL	480	6.1
Test Pit	2.5-5.0	102.3	17.5	-	-	Lean Clay	46	21	24	13	100	100	89	A-7-6 (24)	CL	<200	6.5
B-1	1.0	-	-	10	-	Lean Clay with sand	26	16	10	16	100	92	84	A-4 (6)	CL	<200	6.8
B-1	3.0	-	-	22	-	Lean Clay	36	17	19	11	100	95	88	A-6 (16)	CL	-	-
B-1	5.0	-	-	20	-	Lean Clay	33	15	18	11	100	99	93	A-6 (16)	CL	-	-
B-1	7.5	-	-	26	-	Lean Clay	-	-	-	15	-	-	-	-	CL	-	-
B-1	10.0	-	-	39	-	Lean Clay	41	26	15	18	100	100	96	A-7-6 (17)	CL	-	-
B-1	15.0	-	-	45	-	Lean Clay	-	-	-	15	-	-	-	-	CL	-	-
B-1	21.0	-	-	50/5"	-	Shale	40	22	18	15	100	100	95	-	-	-	-
B-1	25.0	-	-	-	6.8	Shale	-	-	-	-	-	-	-	-	-	-	-
B-2	1.0	-	-	15	-	Silty Clay with sand	24	18	6	11	100	92	85	A-4 (3)	CL-ML	<200	5.9
B-2	3.0	-	-	27	-	Lean Clay	37	18	19	12	100	95	89	A-6 (17)	CL	-	-
B-2	5.0	-	-	37	-	Lean Clay	38	16	22	10	100	99	86	A-6 (18)	CL	-	-
B-2	7.5	-	-	23	-	Lean Clay	44	22	22	16	100	100	95	A-7-6 (23)	CL	-	-
B-2	10.0	-	-	47	-	Lean Clay	37	20	17	14	100	100	96	A-6 (17)	CL	-	-
B-2	15.5	-	-	50/6"	-	Shale	-	-	-	16	-	-	-	-	-	-	-
B-2	20.0	-	-	-	2.5	Shale	39	20	19	15	100	100	97	-	-	-	-

METCO

FIGURE 5

MOISTURE-DENSITY RELATIONSHIP TEST

ASTM D698, D4318, D6913, D2487, D1140, D2216



Method Used	A
Assumed Specific Gravity	2.65
Percent Passing (No #4)	100%

Preparation Method	Dry
Type of Rammer	Mechanical
Percent Retained (No #4)	0%

Maximum Dry Density =100.2 pcf **Optimum Moisture Content =22.5%**

Test Sample	USCS	% < #40	% < #200	LL	PI
Test Results	CL	99.5	85.4	46	25
Material Type	Brown lean Clay with sand				
Material Source	Composit Sample from Test Pit, Approx. 0.0-2.5 feet				

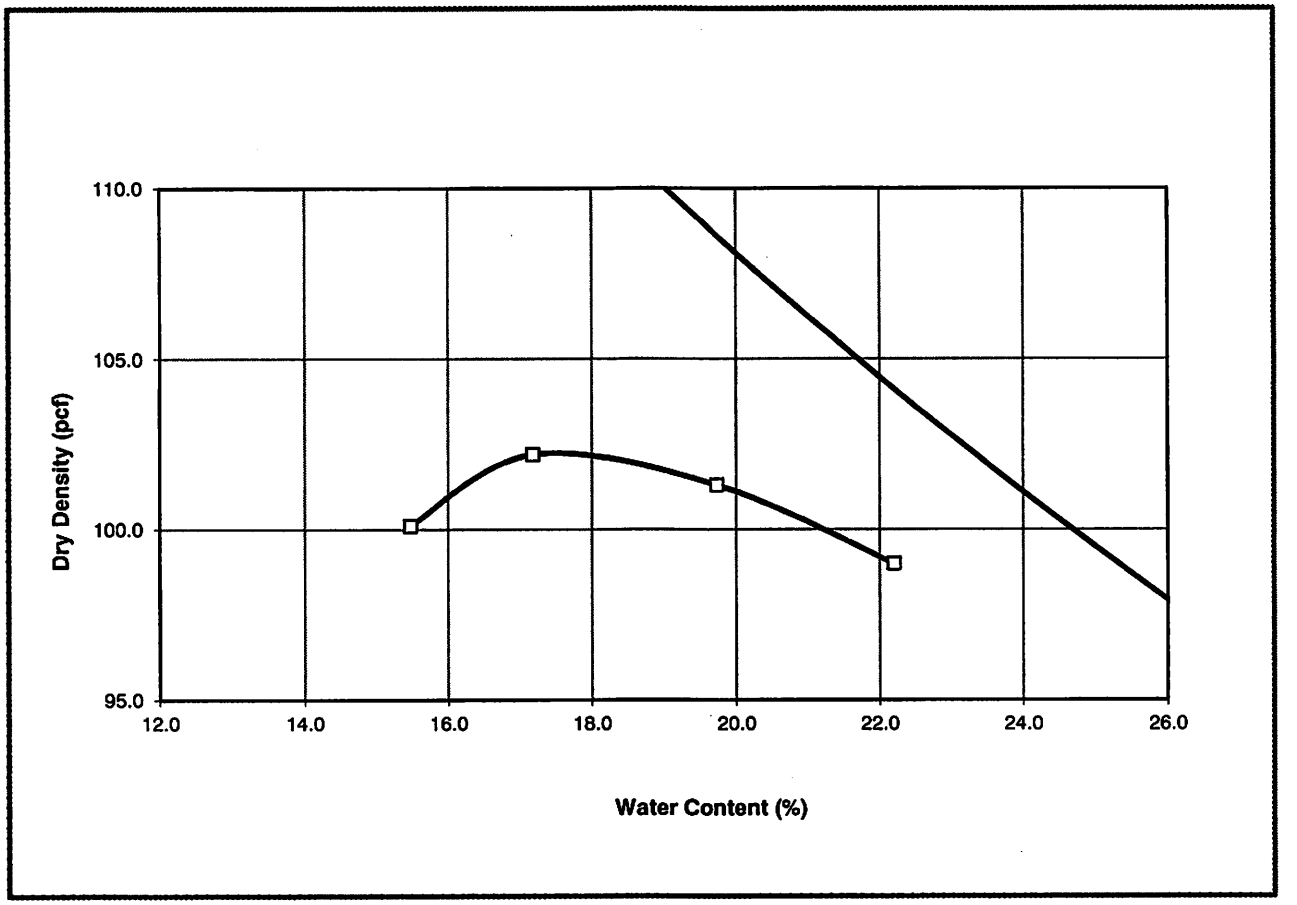
Project No.	OGR-19152-P1
Project Name	Proposed Canadian County Fairgrounds Jensen Road and Alfadale Road
Project Location	El Reno, Canadian County, Oklahoma

Date- 12/14/2019
OGR-19152-P1

FIGURE 6

MOISTURE-DENSITY RELATIONSHIP TEST

ASTM D698, D4318, D6913, D2487, D1140, D2216



Method Used	A
Assumed Specific Gravity	2.65
Percent Passing (No #4)	100%

Preparation Method	Dry
Type of Rammer	Mechanical
Percent Retained (No #4)	0%

Maximum Dry Density =102.3 pcf **Optimum Moisture Content =17.5%**

Test Sample	USCS	% < #40	% < #200	LL	PI
Test Results	CL	99.5	89.3	46	24
Material Type	Brown lean Clay				
Material Source	Composite Sample from Test Pit, Approx. 2.5-5.0 feet				

Project No.	OGR-19152-P2
Project Name	Proposed Canadian County Fairgrounds Jensen Road and Alfadale Road
Project Location	El Reno, Canadian County, Oklahoma

LICENSED PROFESSIONAL ENGINEER
NASIR SALEEM MARAKAH
18194
OKLAHOMA

Date- 12/14/2019
OGR-19152-P2

FIGURE 7

METCO
MIDWEST ENGINEERING & TESTING CORPORATION

GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

PROPOSED CANADIAN COUNTY FAIRGROUND PROJECT
S. ALFADALE ROAD AND E. JENSEN ROAD
EL RENO, CANADIAN COUNTY, OKLAHOMA

Prepared for
CANADIAN COUNTY
201 NORTH CHOCTAW ROAD
EL RENO, OKLAHOMA 73036

Prepared by
MIDWEST ENGINEERING AND TESTING CORPORATION
2025 S. NICKLAS, SUITE 115
OKLAHOMA CITY, OKLAHOMA 73128

405-681-6737

METCO PROJECT NO: OGR-19071

JULY 2019

METC
Midwest Engineering and Testing Corporation

July 19, 2019

Canadian County
201 North Choctaw Road
El Reno, Oklahoma 73036
Phone: 405-295-6000
Fax: 405-422-2429

Attention: Mr. Dave Anderson, Commissioner District 2

Subject: Geotechnical Engineering Services Report
Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma
METCO Project No: OGR-19071

Dear Mr. Anderson:

Midwest Engineering and Testing Corporation (METCO) is pleased to submit this Geotechnical Engineering Services Report for the above-referenced project. The purpose of our services was to assist the design team in designing foundation and general pavement systems and preparing plans and specifications for construction of the proposed project. Our services were completed in general accordance with the scope of work as outlined in METCO proposal number OGP-19079 dated May 9, 2019. Written authorization was provided by Mr. David Anderson, Chairman, of Board of Canadian County Comm. on May 20, 2019. A summary report along with our formal detailed geotechnical engineering services report is enclosed for your review. **The entire report should be read in its entirety prior to utilizing any of the presented information for design or construction purposes.**

Executive Summary

A total of 7 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by Canadian County, the borings were drilled within the general vicinity of the proposed new construction areas. These borings were drilled to approximate depths of 11.5 feet to 25.0 feet below existing grade. Location and depth of the borings were selected by Canadian County. Locations of the proposed new construction as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Indications of possible fill soils were not encountered in the borings. **However, fill soils may exist to various depths at other site locations**. Below approximately 3.0 inches to 4.0 inches of grass and topsoil, the borings generally encountered soils consisting of clay to approximate depths of 11.5 feet to 20.5 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 7 to 57 blows per foot (bpf) of penetration indicating firm to hard consistencies in the cohesive soils. Below the upper soils and extending to boring termination depths of approximately 25.0 feet below existing grade, the deeper building borings encountered soft to hard shale.

Based on laboratory testing, the subsurface tested soils are susceptible to moderate to high swell potential.

Groundwater was encountered in the deeper building borings, at approximate depths of 10.5 feet to 17.0 feet below existing grade at the time of drilling, end of day and/or within 24 hours of completion of drilling. Groundwater was not encountered in the remaining borings B-6 and B-7 at completion of drilling and end of day. **However, it is possible that transient saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. It is strongly recommended that the contractor determine the actual groundwater levels prior to construction.**

Summary of Recommendations

In general, we recommend that all structural improvement areas be drained of any surface water, and stripped of topsoil materials, if any, **existing underground and/or overhead utilities, if any existing fill, if any, soft soils, any organic material,** any asphalt, any concrete, any gravel, if any, any old foundations, old underground storage tanks or basements, if any, burn pits, if any, and any other deleterious materials encountered at the time of construction. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the swell/collapse of the upper soils. Following the removal of all unsuitable onsite debris and vegetation and excavation to the proposed subgrade level, the construction area should be proof-rolled with a tandem axle dump truck or similar rubber-tired vehicle. Soils which are observed to rut or deflect excessively under the moving load should be undercut; moisture conditioned and re-compacted in place or replaced with properly compacted fill. **Over excavation of such soils could extend to several feet below the exposed subgrade level.** The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. **After proof-rolling is completed and any soft areas or areas exhibiting rutting or pumping are properly corrected**, the subgrade soils should be scarified and compacted, at the optimum moisture content to +3 percent of the optimum moisture content, to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8-inches below the exposed surface. Fill soils should be placed in 8-inch loose lifts and compacted to at least 95% of maximum dry density as determined by ASTM Designation D 698 at -1 percent of optimum moisture content to +3 percent of the optimum moisture content.

Based on the results obtained from our exploration and analysis, the proposed building can be supported on conventional shallow spread footings **founded on existing non-expansive stiff soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill**. Shallow spread footings for building columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,000 and 1,600 pounds per square foot, respectively at a minimum depth of 24 inches below final grade. **A gravel base may be required depending on the actual soil conditions at the time of construction. Proper observation of the footing excavations by METCO representatives is essential for the performance of the structure. Once the final design and grading plans are complete, METCO should be contracted for additional analysis**.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

As an alternate foundation system, a drilled pier and grade beam foundation system can be used for support of the column loads and wall loads, respectively. The base of the drilled piers should bear a minimum of 3.0 feet or one pier diameter, **whichever is deeper**, into the rock strata. The rock strata were encountered in the deeper building borings at approximate depths of 15.5 feet to 20.5 feet below existing grade. **However, the rock strata depths may significantly vary across the site**. The drilled piers can be designed for a maximum allowable end bearing pressure of 20,000 psf, based on dead plus design live loads. An allowable skin friction of 2,000 psf can be utilized for that portion of the pier extending more than 3 feet or one pier diameter, whichever is deeper, into the rock strata. **The bearing strata depths should be verified prior to construction. Difficulties might be encountered during drilling due to the nature of the subsurface formation. Additional drilling should be performed prior to final design and construction. The drilled piers should be at least 3 pier diameters deep.**

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

The weathering process of shale is erratic and variations in the shale profiles can be expected in small lateral distances.

It should be noted that TCP results in the bore holes ranged from 1.3 inch for 100 blows to 4.0 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

The piers should be reinforced for their full depth with reinforcing steel. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the soils based on soil adhesion of 900 psf over the upper 10 feet of the pier shaft. Soft or loose soil encountered at the bearing level should be removed. All loosened soils should also be removed. If personnel entry into the shaft is required, a 30-inch minimum diameter is recommended.

A slump of 5 to 7 inches is desired to reduce the potential for forming of voids as the casing is extracted and groundwater related problems. Foundation excavations should be filled with concrete as soon as possible to reduce the potential of groundwater related problems. **To reduce difficulties associated with sloughing and/or groundwater related problems and to facilitate observation, the use of temporary casing might be required.**

Grade beams can be supported on a minimum of 6-inch void space between the bottom of the beams and the underlying soils. Cardboard forms can be used to provide the required void space. Care must be taken to maintain the integrity of the cardboard boxes up to the time the concrete is placed. Wet, damaged, or poorly constructed void boxes may collapse under the weight of the concrete.

The floor slab can be grade supported on a minimum of 3.0 feet of properly compacted and tested, non-expansive structural fill materials. Proof rolling, as discussed in this report, should be accomplished to identify any soft or unstable soils, which should be removed from the floor slab area prior to new fill placement and/or floor slab construction.

It is recommended that free draining granular mat be placed beneath the floor slab to enhance drainage and provide increased subgrade strength. Polyethylene sheeting should be placed on

the granular mat to act as a vapor barrier. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage. The floor slab should not be rigidly connected to columns, walls, or foundations, if possible. **Detailed floor slab recommendations are presented in section 5.5 of this report.**

Although fill material was not observed in the borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction areas. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted and tested low plasticity structural fill.**

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The scope of services did not include an environmental site assessment for determining the presence or absence of toxic or hazardous materials in the soil, surface water, groundwater, or air on, below, or around the site. Any statements regarding colors, odors, suspicious, or unusual items are strictly for informational purposes. Prior to further development of this site, an environmental assessment is advisable.

General

The attached entire report should be read and the contents evaluated prior to utilizing our recommendations in the preparation of the design and construction documents. Please refer to the attached report for a more detailed summary of our analysis and recommendations. It is recommended that METCO be retained to provide observation and testing services during construction. Please do not hesitate to contact our office at 405-681-6737.

Respectfully Submitted,

Midwest Engineering and Testing Corporation
CA No. 4198, Expires 06/30/2021

Shafe Saad Aldin, E.I.
Engineer Intern

Nasir Marakah, P.E.
President

Table of Contents

Geotechnical Engineering Services Report
Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma
METCO Project No: OGR-19071
July 2019

1.0 Introduction

Midwest Engineering and Testing Corporation (METCO) has completed a geotechnical exploration and evaluation of the subsurface conditions for the above-referenced project site in general accordance with the scope of work as outlined in METCO proposal number OGP-19079 dated May 9, 2019. Written authorization was provided by Mr. David Anderson, Chairman, of Board of Canadian Comm. on May 20, 2019.

2.0 Project Description

Based on project information provided, we understand the proposed construction will consist of the following:

Building	New Single-Story Buildings Without Basements Ground Supported Floor Slabs Less than 60 Kip Column Loads, 3.0 KLF Continuous Loads
Grading	Less Than 2 Feet of Cut/ Fill, Each at The Proposed Building Areas
Pavement	Asphaltic Concrete and/or Rigid Pavement

Once the final grading plans are available, METCO should be contracted for additional analysis. Modifications to the presented recommendations may be warranted and should be expected based on the final grading plans. Ground elevations at the boring locations should be determined by others prior to any grading activities.

If potential settlements cannot be tolerated, crushed stone should be used to backfill and deep fill areas to within 5 feet of final grade.

If some settlements can be tolerated, material such as GW, GM, SW, SM and SC with a plasticity index (PI) of 9 or less should be used to backfill any deep fill areas to approximately 5.0 feet below final grade. Select fill should be placed in loose 6-inch lifts and should be compacted, at 1 percent below optimum to 3 percent above the optimum moisture content, to 98 percent of the modified Proctor maximum dry density ASTM D1557. Any placed fill should be monitored prior to and during construction.

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavations or on prepared subgrade of the construction areas either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

If the groundwater levels are expected to be near the expected excavation levels in the proposed construction areas, dewatering prior to and after construction will be required.

The design engineer should consider the effects of groundwater. A comprehensive drainage system should be designed to prevent the damages to the proposed structure, if deemed necessary by the design engineer.

It should be noted that TCP results in the bore holes ranged from 1.3 inch for 100 blows to 4.0 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

The location of the site is shown on the Site location Map.

3.0 Scope of Work

The purpose of this exploration and evaluation was to assess the subsurface soil conditions at the project site, at the boring locations, in order to help in the evaluation of acceptable foundation and general pavement systems for the proposed project.

Our scope of services included the items presented in the following sections.

3.1 Subsurface Exploration

A total of 7 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by Canadian County, the borings were drilled within the general vicinity of the proposed new construction areas. These borings were drilled to approximate depths of 11.5 feet to 25.0 feet below existing grade. Location and depth of the borings were selected by Canadian County. Locations of the proposed new construction as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Soil samples were taken at regular intervals during the drilling process. Samples were identified in the field, placed in sealed plastic bags, and transported to the laboratory for further classification and testing.

When the split spoon sampler was used, Standard Penetration Tests (SPT's) were performed at regular intervals in general accordance with ASTM Designation D1586, samples collected, and results presented on the boring logs. The SPT used in soil borings is performed by driving a 2-inch, O.D., split-spoon sampler into the undisturbed formation located at the bottom of the advanced auger with repeated blows of a 140-pound, pin-guided, hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler one foot is a measure of the soil consistency.

When the Texas Cone Penetration test was used to evaluate the bedrock, the cone was driven into the bedrock material with a 140-pound automatic hammer that falls 30 inches. After the cone was seated, the distance the TCP is driven was recorded after each of two 50 blow counts.

3.2 Laboratory Evaluation

Selected samples of the subsurface soils were tested in the laboratory to determine materials properties for further evaluation and approximate unified soil classifications were determined by visual inspection. The laboratory evaluation consisted of visual and textural examinations,

moisture content, Atterberg limit tests and percent passing the No. 200 sieve. Results of the tests are shown on the attached logs of borings and in the appendix.

3.3 Engineering Analysis

Engineering analysis and recommendations regarding general foundation design including allowable soil bearing pressures, minimum depth requirements, and estimates of foundation settlement are included in this report. In addition, recommendations were developed addressing site preparation, placement and compaction of fill materials, and site preparation of the floor slab areas.

This geotechnical engineering report presents recommendations derived from existing and available information pertaining to the proposed project; relevant laboratory data, information, and test results; subsurface materials encountered in our borings, and the proposed new construction locations. The attached entire report should be read and the contents evaluated so that to facilitate any changes that may be desired. If any changes or corrections are desired, please inform METCO in writing so that we may amend the presented recommendations.

METCO cannot be responsible for the interpretation or implementation of this report by others. METCO should be retained to provide observation and testing during construction. Foundations, earthwork, and all other construction related activities should be observed by METCO. METCO will not accept any responsibility for the performance of the subgrade, foundations, any structure or pavement for this project nor will it accept any responsibility for any conditions which deviated from those described in this report.

4.0 Surface and Subsurface Features

4.1 Site Description

The subject property is approximately located at the northwest corner of the intersection of S. Alfadale Road and E. Jensen Road in El Reno, Canadian County, Oklahoma. The proposed construction area was covered with grass and visually appeared to be relatively level with a gentle slope to the south and southwest. Some utilities and buildings existed in the general vicinity of the proposed construction areas. The surface conditions were relatively dry and our truck-mounted drill rig experienced no difficulty in moving around the site.

4.2 Soil Subsurface Conditions

Indications of possible fill soils were not encountered in the borings. **However, fill soils may exist to various depths at other site locations**. Below approximately 3.0 inches to 4.0 inches of grass and topsoil, the borings generally encountered soils consisting of clay to approximate depths of 11.5 feet to 20.5 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 7 to 57 blows per foot (bpf) of penetration indicating firm to hard consistencies in the cohesive soils. Below the upper soils and extending to boring termination depths of approximately 25.0 feet below existing grade, the deeper building borings encountered soft to hard shale.

Laboratory tests indicated that the site soils had plasticity indices ranging from 13 to 29 and grain size distribution tests show that the tested soils contain about 72 to 98 percent fines (that material passing a No. 200 mesh sieve). The encountered soils were classified as CL in accordance with the Unified Soil Classification System.

Based on the results of our laboratory-tests and our experience with other sites in the general vicinity, the on-site tested soils are susceptible to moderate to high swell potential. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the collapse/swell of the upper soils.

Although fill material was not observed in the borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction areas. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted and tested low plasticity structural fill.**

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The above description of the subsurface conditions constitutes a generalization that emphasizes the subsurface stratification features and characteristics. The data and information at the specific boring locations are recorded in the boring logs. These logs present a description of subsurface soil and rock, applicable laboratory and field test results, sample location, and general stratification. Variations in the stratification presented in the boring logs should be expected across the site and between boring locations as the presented strata description is only indicative of the boring locations.

4.3 Groundwater

Groundwater was encountered in the deeper building borings, at approximate depths of 10.5 feet to 17.0 feet below existing grade, at the time of drilling, end of day and/or within 24 hours of completion of drilling. Groundwater was not encountered in the remaining borings, borings B-6 and B-7, at completion of drilling and end of day. **However, it is possible that transient saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. It is strongly recommended that the contractor determine the actual groundwater levels prior to construction.**

4.4 Seismic Considerations

IBC Seismic Zone Coefficients

Earthquake related design parameters may be obtained from the International Building Code 2015 Edition, using *a Site Class **C** Definition.*

If site-specific earthquake response spectra or other specific design parameters are deemed necessary by the project structural engineer, or are required by the local governmental agency

who has jurisdiction over the project, the geotechnical engineer should be promptly informed so that the appropriate analysis can be performed. In addition, design of structures should comply with the requirements of the governing jurisdiction's building codes and standard practices of Oklahoma.

5.0 Evaluation and Recommendations

Based on the results of our fieldwork, laboratory evaluation, and engineering analysis, the proposed building can be supported on shallow spread footings **founded on exiting stiff non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill** at a minimum depth of 2.0 feet below final grade.

As an alternate foundation system, the proposed building can be supported on a drilled pier foundation system bearing a minimum of 3.0 feet or one pier diameter, whichever is deeper, in the rock strata. Other types of foundation systems can be evaluated, if desired.

Once the final grading plans are available, METCO should be contracted for additional analysis. Modifications to the presented recommendations may be warranted and should be expected based on the final grading plans. Ground elevations at the boring locations should be determined by others prior to any grading activities.

If potential settlements cannot be tolerated, crushed stone should be used to backfill and deep fill areas to within 5 feet of final grade.

If some settlements can be tolerated, material such as GW, GM, SW, SM and SC with a plasticity index (PI) of 9 or less should be used to backfill any deep fill areas to approximately 5.0 feet below final grade. Select fill should be placed in loose 6-inch lifts and should be compacted, at 1 percent below optimum to 3 percent above the optimum moisture content, to 98 percent of the modified Proctor maximum dry density ASTM D1557. Any placed fill should be monitored prior to and during construction.

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction areas either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

If the groundwater levels are expected to be near the expected excavation levels in the proposed construction areas, dewatering prior to and after construction will be required. The design engineer should consider the effects of groundwater. A comprehensive drainage system should be designed to prevent the damages to the proposed structure, if deemed necessary by the design engineer.

It should be noted that TCP results in the bore holes ranged from 1.3 inch for 100 blows to 4.0 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

Generally, similar structures as that proposed are designed for post-construction vertical slab movements of less than 1 inch. Consideration must be given to the presence of moderately plastic clays within the proposed construction areas. These soils may exhibit significant

volumetric changes with changes in their moisture content. We estimate the potential vertical rise (PVR) to be on the order of 2.3 inches. These movements are based on the worst-case dry soil conditions. It was estimated that the PVR for a floor slab supported on a minimum of 3.0 feet of low plasticity structural fill to be on the order of less than 1 inch.

5.1 Site Preparation

Typically, it is recommended that prior to general site grading, **all topsoil, any existing fill material, any organic material, any underground utilities and/or overhead utilities,** existing concrete, if any, asphalt, gravel, any old foundations, any old underground storage tanks, if any if any, and any other deleterious materials encountered at the time of construction **and soft soils** should be stripped from the proposed construction area. The depth of required removal should be evaluated by a representative of the geotechnical engineer at the time of construction. The resulting excavations should be widened, as necessary, to allow access to compaction equipment. **The site was cleared prior to our field activities.**

Once the proposed subgrade level has been exposed, the construction area should be proof-rolled during a period of dry weather. **A representative of the geotechnical engineer should observe the exposed subgrade for soils that rut or deflect under the moving load.** Such soils should be recompacted or replaced with properly compacted fill. **Over excavation of such soils could extend to several feet below the exposed subgrade level. Stabilization of the subgrade soils and/or a gravel base may be required depending on the actual soil conditions at the time of construction. After proof-rolling is completed and any soft areas or areas exhibiting rutting or pumping are properly corrected**, the top 8 inches of the exposed subgrade should be scarified; moisture conditioned, if necessary, and compacted, at the optimum moisture content to +3 percent of optimum moisture content, to 95 percent of the standard Proctor maximum dry density ASTM D698.

Any fill should have a liquid limit of 35 or less and a plasticity index of 5 to 15, be 3 inches or less in particle size, and should be free of organic or any deleterious materials. Fill should be placed in loose 8-inch lifts and should be compacted at 1 percent below optimum to 3 percent above the optimum moisture content. The first layer of fill material should be placed in a relatively uniform horizontal lift and be keyed into the prepared subgrade soils.

Based on the laboratory test results, most of the on-site tested soils are not-suitable for use as structural fill. However, these soils should be tested in bulk at the time of construction. If a fine-grained clay soil is used for fill, close moisture content control will be required to achieve the recommended degree of compaction. If water is added, it should be uniformly applied and thoroughly mixed into the soil. Structural fill should be compacted to at least 95 percent of standard Proctor maximum dry density as determined by ASTM Designation D 698.

It is recommended that each compacted-engineered lift be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. It is also recommended that the compacted fill be extended 5 feet beyond the edges of the building.

5.2 Foundation Support

Based on the results obtained from our exploration and analysis, the proposed structures can be supported on conventional shallow foundation systems. Shallow spread footings for building

columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,000 and 1,600 pounds per square foot, respectively, **bearing on existing stiff non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill at a minimum depth of 24 inches below final grade.** To reduce the possibility of local bearing capacity failure, minimum dimensions of 24 inches for column footings and 18 inches for continuous footings should be used in foundation design. The footings should be provided with appropriate reinforcement as determined by the structural engineer. **Proper observation of the footing excavations by METCO representatives is essential for the performance of the structure. Once the final design and grading plans are complete, METCO should be contracted for additional analysis.**

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

A one third increase in bearing value can be used for wind and seismic load considerations. Since the recommended bearing value is a net value, the weight of the concrete in the footings may be assumed to be 50 pounds per square foot. The weight of the soil backfill may be neglected for downward load contribution.

A representative of METCO should observe the foundation excavations prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. **Soft or loose soil zones encountered at the bottom of the footing, excavations should be removed to the level of stiff or dense soil as directed by the geotechnical engineer.** Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with engineered fill, as determined by the geotechnical engineer. METCO should be contacted to evaluate moisture issues, if needed.

An ultimate coefficient of friction of 0.47 can be used between the base of footings and the floor slab and the supporting soils to resist lateral loads. In addition, lateral loads can be resisted by a uniform ultimate passive key resistance of 130 pounds per square foot, for keys embedded at least 2.0 feet below final grade. A one third increase in the passive value can be used for wind and seismic loads. The frictional resistance and the passive resistance of the soils can be combined without any reductions in determining the total lateral resistance.

We estimate that foundations designed and constructed in accordance with the above recommendations will experience total settlements generally less than 1-inch with differential settlements generally less than ¾ inches within the building area. **It should be noted that additional settlements of approximately 1 to 2 percent of placed fill height should be accounted for in the design.** Consolidation testing was beyond the scope of this exploration.

5.3 Alternate Foundation System

As an alternate foundation system, a drilled pier and grade beam foundation system can be used for support of the column loads and wall loads, respectively. The base of the drilled piers should bear a minimum of 3.0 feet or one pier diameter, **whichever is deeper**, into the rock strata. The rock strata were encountered in the deeper building borings at approximate depths of 15.5 feet to 20.5 feet below existing grade. However, **the rock strata depths may significantly vary at other site locations**. The drilled piers can be designed for a maximum

allowable end bearing pressure of 20,000 psf, based on dead plus design live loads. An allowable skin friction of 2,000 psf can be utilized for that portion of the pier extending more than 3 feet or one pier diameter, whichever is deeper, into the rock strata. **The bearing strata depths should be verified prior to construction. Difficulties might be encountered during drilling due to the nature of the subsurface formation. Additional drilling should be performed prior to final design and construction. The drilled piers should be at least 3 pier diameters deep.**

The weathering process of shale is erratic and variations in the shale profiles can be expected in small lateral distances.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

The piers should be reinforced for their full depth with reinforcing steel. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the soils based on soil adhesion of 900 psf over the upper 10 feet of the pier shaft.

Soft or loose soil encountered at the bearing level should be removed. All loosened soils should also be removed. If personnel entry into the shaft is required, a 30-inch minimum diameter is recommended.

Pier excavations should be observed by a representative of the geotechnical engineer to assess that the foundation soils have adequate strength to support the design loads and are consistent with the soil encountered in our borings. **To reduce difficulties associated with sloughing and/or groundwater related problems and to facilitate observation, the use of temporary casing might be required.**

A slump of 5 to 7 inches is desired to reduce the potential for forming of voids as the casing is extracted. Foundation excavations should be filled with concrete as soon as possible to reduce the potential of groundwater related problems.

Installation of a test pier during the design stage can be beneficial. The installation of a test pier can aid in the evaluation of potential difficulties that might occur during construction and in verifying the depth of the bearing formations.

5.4 Grade Beams

Grade beams can be supported on a minimum of 6-inch void space between the bottom of the beams and the underlying soils. Cardboard forms can be used to provide the required void space. Care must be taken to maintain the integrity of the cardboard boxes up to the time the concrete is placed. Wet, damaged, or poorly constructed void boxes may collapse under the weight of the concrete. It is recommended that suitable rigid protection be installed along the outer and inner edges of the grade beams to prevent backfill material from collecting in the void space beneath the grade beams.

5.5 Floor Slab Recommendations

Floors slabs can be grade supported on a minimum of 3.0 feet of properly compacted and tested, non-expansive structural fill materials. **Floor slabs should be supported directly by 4.0 inches to 6.0 inches of Aggregate Base Course (ABC); over 32.0 inches to 30.0 inches, respectively of non-expansive soil meeting the requirements outlined above.** This material will act as a leveling base and aid in concrete curing. This material will not act as a positive moisture break to prevent moisture rise to the slab. If the floor covering is considered moisture sensitive, plastic sheeting should be placed over the base course. **Any existing fill should be removed prior to fill placement and/or floor slab construction.**

A modulus of subgrade reaction (k) of 100 pounds per cubic inch is recommended for floor slabs overlying the graded gravel base and a compacted subgrade. The floor slabs should have an adequate number of joints to reduce cracking resulting from possible differential movements. The floor slabs should not be rigidly connected to columns, walls, or foundations, if possible. **Floor slab design is not typically the area of expertise of the Geotechnical Engineer and should be verified by the Structural Engineer of Record.**

All construction activity may cause damage and deterioration to the prepared subgrade. We recommend our field representative observe the final subgrade prior to placement of the slab on grade, and perform further testing as necessary.

5.6 Pavement Recommendations

We have assumed typical area soil parameters for pavement design. Our study did not include CBR testing or detailed pavement analysis for the subgrade soils or imported soils. A more detailed analysis of the subgrade and traffic conditions should be made in large areas of pavement, or where pavements are subject to significant traffic. The results of such analysis will provide the needed information for the design of an economical and serviceable pavement. **The project civil engineer should design the actual pavements based on site-specific traffic information.**

The pavement thicknesses presented in the table below are considered area typical and minimum for the assumed parameters. Thinner pavement sections than those presented in the table might be warranted due to budgetary considerations. However, Canadian County, and all parties involved should be aware that increased maintenance costs and lower pavement life might be expected with thinner pavement sections. The subgrade should be prepared as recommended in this report.

With an assumed CBR value of 3, a typical standard pavement section consisting of the following could be used:

Asphalt Concrete Flexible Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways
Asphaltic Surface Course	2"	2"
Asphaltic Binder Course	3"	5"
Crushed Stone Base	8"	8"

Concrete Rigid Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways, trash dumpsters area, areas of large loads from small steel wheels
Concrete Pavement	5"	7"
Crushed Stone Base	8"	8"

Providing the proper pavement type and thickness will result in better distribution of surface loads to the subgrade without causing deformation of the surface. Proper compaction, fine grading and proof-rolling should supercede pavement placement. The work should be done in accordance with Oklahoma State Department of Transportation guidelines or other applicable guidelines.

The base stone should not get saturated and water should not be allowed to pond behind curbs. To allow water entering the base stone a path to exit, base stone should extend through the slope in down grade areas.

The pavement concrete should have a compressive strength of at least 3,500 psi with 3% to 6% air entrainment. This concrete should be saw-cut as directed by the design engineer. The pavement should be adequately reinforced with steel. As minimum, the reinforcement steel should be No. 3 bars on a maximum spacing of 18 inches each way. The final pavement section should be designed by the Civil Engineer.

5.7 Lime/ Fly Ash Stabilization

Consideration should be given to lime/fly ash stabilization to improve the parking and driveway subgrade soils. Stabilizing the top 8 inches of the subgrade soil in the parking and driveway areas, will improve the subgrade soils. **The actual lime/fly ash percentage should be determined at the time of construction.**

Sulfate tests and other appropriate tests should be performed prior to the final selection of the stabilizing material.

5.8 Drainage Considerations

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction area either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, or positive run-off. The contractor should exercise care in creating drainage paths for water during the construction phase of the project. Curbing adjacent to landscaped areas should be designed deep enough to act as a barrier between the landscape irrigation and the subgrade soil. Surface run-off from roofs, parking areas, etc., should be discharged away from the structures. To reduce infiltration of surface water around the

perimeter of the building and beneath the floor slabs, positive drainage should be provided. If groundwater issues are encountered during construction, METCO should be contacted.

5.9 Excavation and Temporary Slopes

The contractor, designated as "responsible person" in OSHA Construction Standards for Excavations, 29 CFR Part 1926, is solely responsible for planning and implementing all safety procedures. All excavation height, slope, and depth must adhere to all specifications outlined in local, state, and federal safety regulations.

METCO does not assume any responsibility for construction site safety or any party's, including the contractor, compliance with the applicable local, state, and federal safety regulations or any other applicable regulations.

5.10 Trench Backfill

All required trench backfill should be mechanically compacted in layers to at least 95% of the standard Proctor maximum dry density as determined by ASTM Designation D 698. Some settlement of the backfill may be expected and any utilities within the trenches or concrete walks supported on the trench backfill should be designed to accept these differential movements.

5.11 Weather Considerations

The upper soils encountered at this site may be sensitive to moisture variations and construction traffic disturbances during wet weather. The soil strength is significantly reduced when the soil is wet and significant delays in the grading and compaction activities can take place. Thus, it is advantageous to perform construction activities during periods of dry weather.

5.12 Construction Monitoring

METCO should be retained to provide observations and testing of soil exposures created during project construction in order to verify that soil conditions are as anticipated and are as encountered in our borings. Construction activities pertaining to earthwork, foundations, and all other related activities should also be observed by METCO representatives. METCO cannot accept any responsibility for the performance of the subgrade, foundations, any structure or pavement for this project. Furthermore, METCO cannot accept any responsibility for conditions which deviated from those described in this report.

6.0 General

The conclusions and recommendations presented in this report are subject to the following general conditions:

6.1 Use of Report

This report has been prepared for the exclusive use of Canadian County, for the specific application for the Proposed Canadian County Fairground Project, located at the northwest corner of S. Alfadale Road and E. Jensen Road in El Reno, Canadian County, Oklahoma. This report should not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us. Unless our written approval is provided, we make no representation and assume no responsibility to other parties regarding this report.

6.2 Level of Care

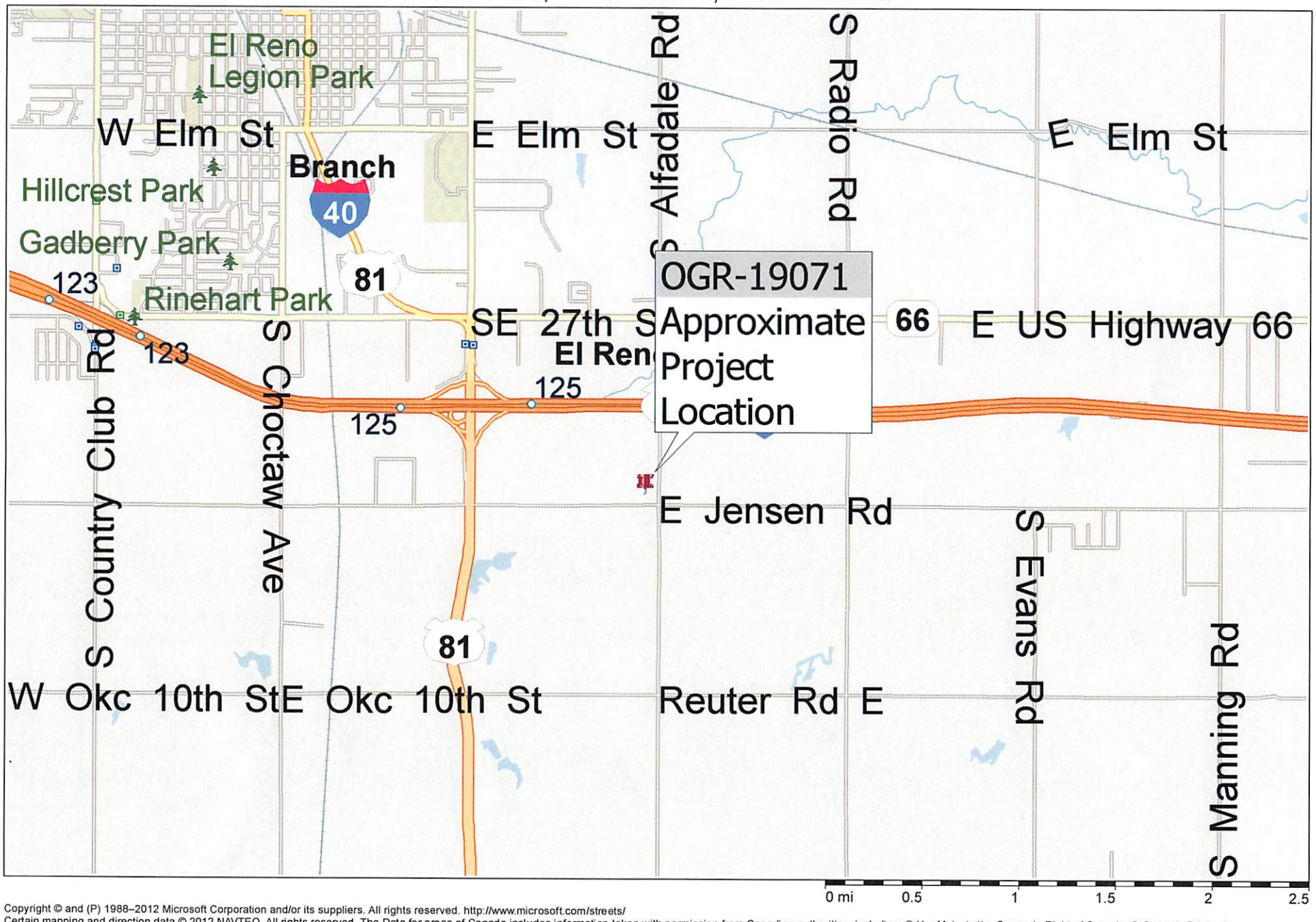
The recommendations contained in this report are based on the available subsurface information obtained by METCO, and design details furnished for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, METCO should be notified immediately to determine if changes in the foundation recommendations are required. If METCO is not retained to perform these functions, METCO will not be responsible for the impact of those conditions on the project.

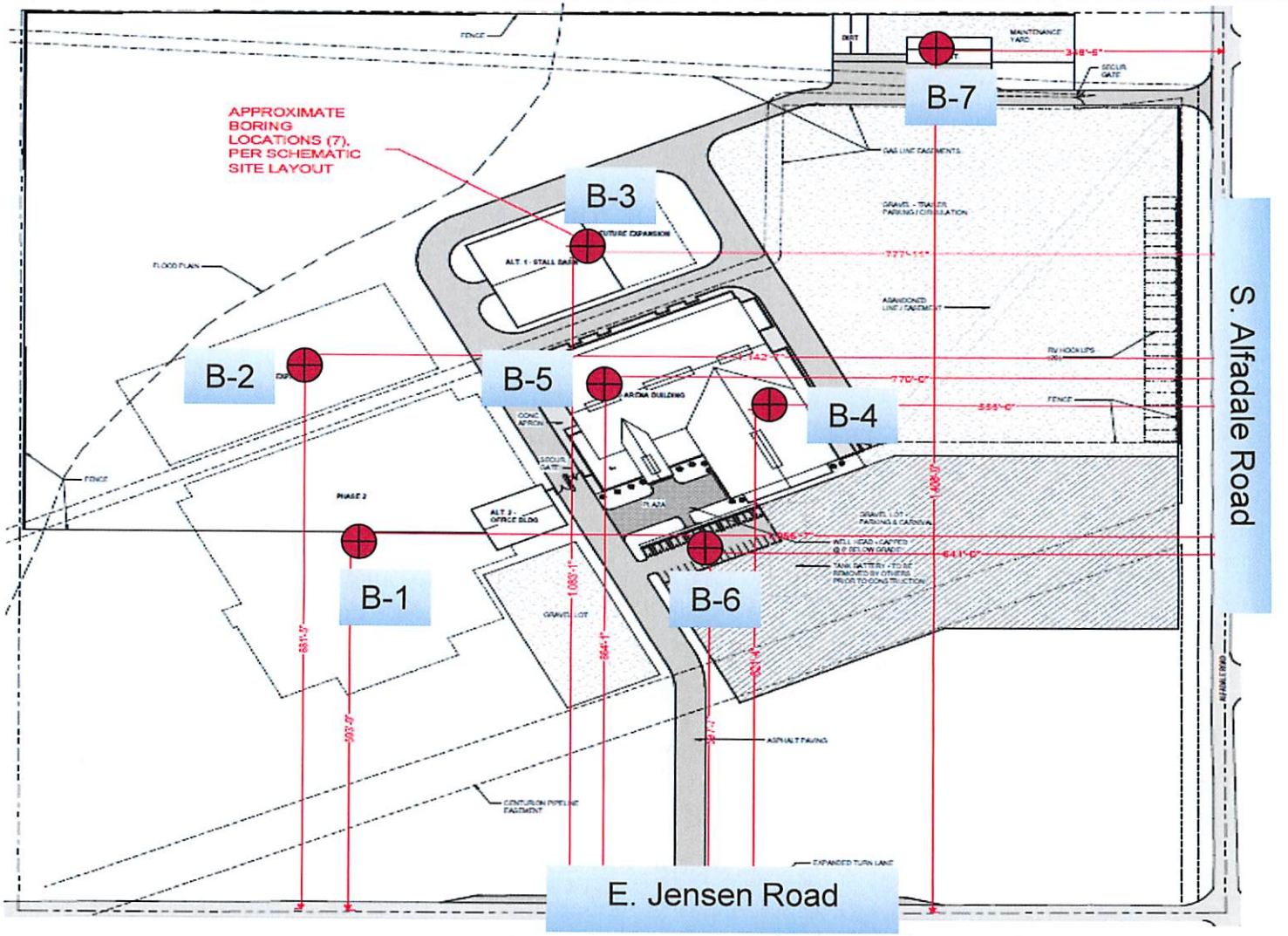
Services performed by the geotechnical engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. **No warranty, expressed or implied, is made**.

APPENDIX


OGR-19071
Aproximate Project Location
Legend
OGR-19071
Remington Dr
Grimes Dr
S Hwy 81 Srv Rd
40
OGR-19071
S U.S. 81 Service Rd
81
S Alfadale Rd
Je
N
3000 ft
Google Earth
© 2018 Google

Oklahoma, United States, North America





Approximate Boring Location
Not to Scale

N

PLAN OF BORINGS

Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma

METCO JOB#: OGR-19071

FIGURE 1

METCO

LOG OF BORING B-1

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: 17.0' Depth To Water On: 6/29/2019 Was: 11.8'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1			3.0" Grass and topsoil							
2		5/6" 8/6" 9/6"	Dark brown lean Clay with sand, calcareous nodules and roots, very stiff (CL)	15	40	21	19	85		
3										
4		10/6" 14/6" 15/6"		9						
5										
6		9/6" 11/6" 14/6"	Reddish brown lean Clay with iron stains, very stiff to hard (CL)	10	32	15	17	92		
7										
8		14/6" 15/6" 16/6"	Reddish brown lean Clay with iron stains and calcareous nodules, hard (CL)	9						
9										
10										
11		19/6" 29/6" 28/6"	Reddish brown lean Clay with iron stains, hard (CL)	13	36	19	17	94		
12										
13										
14										
15										
16		16/6" 14/6" 21/6"	Reddish brown lean Clay with calcareous inclusions, hard (CL)	17						
17										
18										
19										
20										
21		50/6"	Reddish brown Shale, soft to hard	19						
22										
23										
24										
25		100/1.8"	TC @ 25.0' : 50/1.3", 50/0.5"	28	32	17	15	91		
26										
27										
28										
29										
30										

NOTES:

METCO

FIGURE 2

LOG OF BORING B-2

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: 6/29/2019 Was: 10.3'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		5/6"	3.0" Grass and topsoil							
2		8/6"	Brown lean Clay with iron stains, stiff to very	13	35	18	17	86		
3		8/6"	stiff (CL)							
4		7/6"	Brown to reddish brown lean Clay with iron	12	38	17	21	86		
5		9/6"								
6		13/6"	stains and calcareous inclusions, very stiff to	10						
7		4/6"	hard (CL)							
8		21/6"								
9		23/6"								
10		6/6"	Reddish brown lean Clay with sand, hard	11	28	15	13	79		
11		16/6"	(CL)							
12		20/6"		14						
13		24/6"								
14		31/6"								
15		26/6"								
16		43/6"		13						
17		50/5"	Reddish brown Shale with gray silty layers,							
18			soft to hard							
19										
20										
21		100/2.0"	Reddish brown Shale, hard	13	31	16	15	98		
22			TC @ 20.0' : 50/1.5", 50/0.5"							
23										
24										
25		100/1.3"	TC @ 25.0' : 50/1.0", 50/0.3"	14						
26										
27										
28										
29										
30										

NOTES:

METCO

FIGURE 3

LOG OF BORING B-3

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma | Project No.: OGR-19071

Date Drilled: 6/28/2019 | Location: See Plan of Borings (Figure 1) | Elevation: N/A

Depth To Water At Completion: Dry | Depth To Water On: 6/29/2019 | Was: 11.6'

Drilled By: Kalyn | Logger: Stephen | Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		2/6" 4/6" 5/6"	3.0" Grass and topsoil Brown lean Clay with iron stains, stiff to very stiff (CL)	17	34	17	17	86		
4		4/6" 9/6" 11/6"	Reddish brown lean Clay with calcareous inclusions, very stiff (CL)	13	34	15	19	91		
6		8/6" 12/6" 13/6"	Reddish brown lean Clay with sand, iron stains and calcareous inclusions, very stiff to hard (CL)	15						
9		8/6" 11/6" 16/6"		12	27	13	14	83		
11		12/6" 20/6" 24/6"		22						
16		20/6" 50/5"	Reddish brown Shale with gray silty layers, soft to moderately hard	16						
21		100/3.3"	Reddish brown Shale, moderately hard TC @ 20.0' : 50/2.0", 50/1.3"	16						
25		100/2.8"	TC @ 25.0' : 50/1.8", 50/1.0"	14	33	18	15	97		

NOTES:

METCO

FIGURE 4

LOG OF BORING B-4

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: 6/29/2019 Was: 12.8'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.3'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		4/6"	3.0" Grass and topsoil							
2		4/6"	Dark brown lean Clay with calcareous nodules, firm to stiff (CL)	17	40	19	21	87		
3		4/6"								
4		3/6"	Reddish brown lean Clay with sand, iron stains and calcareous nodules, stiff (CL)	12	33	15	18	76		
5		7/6"								
6		7/6"	Brown lean Clay with sand, stiff (CL)	10	30	15	15	78		
7		8/6"								
8		6/6"		8	29	15	14	75		
9		5/6"								
10		7/6"								
11		1/6"	Brown lean Clay with sand and gravel, stiff to very stiff (CL)	14	27	14	13	72		
12		6/6"								
13		10/6"								
14										
15										
16		7/6"	Reddish brown lean Clay with calcareous inclusions, very stiff to hard (CL)	17	44	23	21	98		
17		11/6"								
18		17/6"								
19										
20				18						
21		25/6"	Reddish brown Shale, soft to moderately hard							
22		50/5"								
23										
24										
25			TC @ 25.0' : 50/2.8", 50/1.2"	19						
26		100/4.0"								
27										
28										
29										
30										

NOTES:

METCO

FIGURE 5

LOG OF BORING B-5

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: 6/29/2019 Was: 14.6'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		2/6" 4/6" 9/6"	3.0" Grass and topsoil Dark brown to reddish brown lean Clay with roots, stiff to hard (CL)	20	45	21	24	87		
4		9/6" 17/6" 19/6"	Reddish brown lean Clay with iron stains and calcareous nodules, hard to very stiff (CL)	13	45	19	26	95		
6		11/6" 14/6" 14/6"	Reddish brown lean Clay with iron stains and calcareous nodules, very stiff to hard (CL)	22						
8		11/6" 26/6" 31/6"	Reddish brown lean Clay with iron stains and calcareous nodules, hard to very stiff (CL)	21						
11		15/6" 14/6" 12/6"	Reddish brown lean Clay with gray silty layers, very stiff to hard	16	37	21	16	95		
16		15/6" 29/6" 50/6"	Reddish brown Shale with gray silty layer, soft to moderately hard	17						
21		100/3.5"	Reddish brown Shale, moderately hard to hard TC @ 20.0' : 50/2.3", 50/1.2"	16	38	18	20	95		
25		100/2.3"	TC @ 25.0' : 50/1.8", 50/0.5"	15						
26										

NOTES:

METCO

FIGURE 6

LOG OF BORING B-6

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: End of Day Was: Dry

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 11.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1–3		4/6" 4/6" 5/6"	3.0" Grass and topsoil Dark brown lean Clay, stiff (CL)	21	48	22	26	94		
4–5		3/6" 4/6" 8/6"	Reddish brown lean Clay with calcareous inclusions, stiff (CL)	19	40	16	24	86		
6–7		5/6" 6/6" 7/6"	Reddish brown lean Clay with sand and gravel, stiff to firm (CL)	16	35	16	19	80		
8–10		3/6" 3/6" 4/6"	Reddish brown lean Clay with sand, firm to hard (CL)	18	28	15	13	82		
11		12/6" 13/6" 21/6"	Reddish brown lean Clay with iron stains, hard (CL)	18	35	20	15	95		
12–30										

NOTES:

METCO

FIGURE 7

LOG OF BORING B-7

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: End of Day Was: Dry

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 11.5'

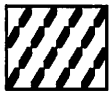
DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1–3		3/6" 5/6" 7/6"	4.0" Grass and topsoil Dark brown lean Clay, stiff to very stiff (CL)	18	48	19	29	90		
4–5		7/6" 12/6" 13/6"	Brown lean Clay with calcareous inclusions, very stiff (CL)	16						
6–7		9/6" 12/6" 13/6"	Reddish brown lean Clay with calcareous inclusions and iron stains, very stiff to hard (CL)	14	41	15	26	93		
8–10		12/6" 20/6" 27/6"		14						
11		10/6" 16/6" 17/6"		15	39	20	19	95		
12–30										

NOTES:

METCO

FIGURE 8

KEY TO SYMBOLS & PATTERNS USED ON BORING LOGS



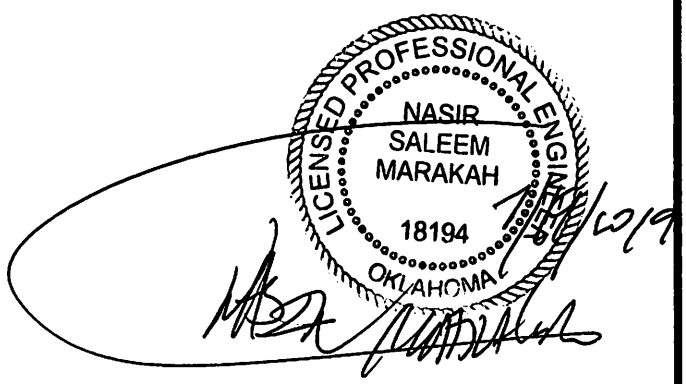
Lean Clay

Shale

Standard Penetration Test

Bag Sample

Texas Cone Penetrometer Test



ABBREVIATIONS USED

MC, %	Moisture Content expressed in percentage
LL	Liquid Limit
PI	Plasticity Index
DD, PCF	Dry Density expressed in pounds per cubic feet
-#200, %	Soil Fraction Passing No. 200 Sieve expressed in percentage
swell, %	Free swell under overburden pressure expressed in percentage
PP, TSF	Pocket Penetrometer Reading expressed in tons per square feet

LINGO

Contract 1111116900

THIS AGREEMENT, made and entered into on the **5th** day of **November, 2016**, by and between

LINGO CONSTRUCTION SERVICES, INC.
1135 North Robinson Ave.
OKLAHOMA CITY, OKLAHOMA 73103
(405) 602.2100

Hereinafter termed "Contractor", and

John Doe's Contracting
PO BOX 1508
DEL CITY, OKLAHOMA 73155

Hereinafter termed "Subcontractor."

The Subcontractor **AGREES** as follows:

1. **The Work.** The Subcontractor agrees to furnish all supervision, tools, material, labor, supplies, and equipment as an independent contractor to perform work required to complete the following. Subcontractor agrees to do no work on this project not covered by this contract for Owners or anyone else without first obtaining written permission from the Contractor.

   a. SYSTEM - $4,996

   Scope of work per drawings and specifications dated: **See attached Exhibit A**

   Base Bid* **$22,454.00**

   ****Twenty Two Thousand, Four hundred and 54/100 Dollars****

   For the Project: **Someplace in OKC**
   000 Main Street
   Oklahoma City, Oklahoma 7310#

   Per the Contract
   Drawings Prepared By: **Architects**
   000 Broadway
   Oklahoma City, Oklahoma 73###

2. **Changes.** Extra Work or Changes under this contract will not be recognized or paid for unless agreed to in writing by Stan Lingo before work is started or changes are made. In the event of a change (additive or deductive) Subcontractor shall only be entitled to reasonable reimbursement for expenditures or savings and shall provide supporting data to justify the claim. Standard billing rates shall be used and overhead and fee percentages shall include, but not be limited to, insurances, taxes, bonds, use of small tools, incidentals and office expenses.

   Costs associated with repairing or correcting damaged or nonconforming Work executed by the Subcontractor, sub-subcontractors or suppliers caused by negligence or failure to fulfill a specific responsibility of the Subcontractor shall not be allowed and are the sole responsibility of the Subcontractor, sub-subcontractor and supplier.

   Subcontractor shall be entitled to any extension of time only to the extent Contractor obtains an extension of time from the Owner, as it pertains to the Subcontractor's work and only if Subcontractor has properly notified Contractor of its claim for an extension.

3. **Taxes, Fees, and Permits.** The contract price specified above is understood to include all applicable State Sales taxes, use taxes, excise taxes, transportation tax, unemployment compensation tax, old age benefits and social security taxes, and Subcontractor agrees to pay all of the above and to conform to all State and Federal laws in connection with such taxes. In addition, Subcontractor further agrees to withhold from all employees employed by Subcontractor, withholding taxes and to pay the same to the Collector of Internal Revenue in accordance with the Federal laws and regulations pertaining thereto. Subcontractor agrees that records related to such matters and confirmation of such payments shall be open to audit, review, and copying by Contractor.

   Prior to beginning work, Subcontractor will provide a W-9 to be on file with Contractor.

   Contractor will obtain the general building permit. Subcontractor shall obtain and pay for all other applicable permits, assessments, bonds, licenses, fee and certificates of inspection necessary to perform the work of this subcontract.

4. **Drawings and Specifications**. All documents will be issued electronically. Subcontractor will keep all field drawings up to date, with but not limited to, all addendums, RFI's and ASI's. If Subcontractor discovers any errors, inconsistencies, conflicts, discrepancies, or omissions in the Contract Documents, Subcontractor will notify Contractor immediately.

5. **Submittals, RFIs, and Mock-ups.** Subcontractor will provide reviewed samples, submittals, shop drawings, and certifications and warranties (per the project specific contract documents) within <u>two (2) calendar weeks</u> of receipt of contract or written notice to proceed for all materials to be provided, unless otherwise agreed to in writing. Submittals and RFIs will be submitted electronically when possible – electronic system information and links to be selected and provided by Contractor's PM.

   Mock-ups may be required for finishes and/or building systems and Subcontractor agrees to cooperate in their development per the contract documents and project manager's direction.

6. **Schedule and Schedule Coordination.**
   <u>General</u>. Sequencing of the work in the field shall be at the Contractor's sole option. The Contractor shall have the right to decide the time, order and priority in which the various portions of the Work shall be performed. Contractor will seek and Subcontractor will provide input for master schedule.

   The Subcontractor agrees and understands that the Subcontractor shall coordinate all of Subcontractor's work, as necessary, with all interrelated trades, as well as with other subcontractors involved with the project to ensure all Subcontractor's items of work included in this subcontract are completed in accordance with the Contract Documents and Project Schedule.

   Subcontractor agrees to provide manpower and equipment necessary to comply with the project schedule and to provide additional crews, equipment, etc. and/or overtime, shift, and weekend work as required to maintain the schedule if the subcontractor falls behind due to its own fault or inclement weather. Subcontractor agrees that adequate on-site supervision shall be provided at any time Subcontractor's work is in progress.

Site Meetings. Contractor shall administer regularly scheduled meetings throughout the progress of the work for the purpose of coordinating and expediting the work. Subcontractor will designate a dedicated representative who is qualified and authorized to make decisions and follow-through with actions required.

7. **Site Coordination.** Site coordination and related matters (delivery locations, subcontractor parking, scheduling of deliveries, hoisting, lay down areas, temporary office needs, etc.) will be discussed at site meetings and are to be coordinated by the Contractor's onsite personnel. Deliveries for major equipment required 48 hours notification in advance of material deliveries. Subcontractor shall be responsible for unloading and hoisting all of its materials, supplies, tools and equipment.

8. **Safety.** The Subcontractor shall be responsible for compliance with all safety rules and regulations under the Occupational Safety and Health Act and other pertinent statutes and ordinances in connection with the work performed by the Subcontractor. Subcontractor will also abide by any site specific or hazardous material safety measures as requested and deemed necessary by Contractor's management and/or field supervision.

   Subcontractor acknowledges that hazards may be present, including but not limited to: silica, lead based paint, and asbestos, and will communicate with Contractor to understand jobsite hazard conditions prior to starting work. Basic Personal Protective Equipment (PPE) including hard hats, safety glasses, and vests are required in accordance with site specific safety conditions.

   Failure to comply with OSHA and site specific safety requirements may, after one (1) written warning, result in expulsion from the site by the Contractor's project manager or on-site supervisor.

   If applicable, Subcontractor shall prepare, submit, and maintain a HAZCOM Program specific to the project, including identifying who will be the designated competent safety person on the job site.

9. **Payment.**

   Terms. **Pay applications are due by the 25th day of each month**.

   The following is required as prerequisite for payment:

   1) **Pay App** - The Subcontractor shall submit a correct and itemized application for payment on "Lingo Invoicing Form" for work completed on site up to and including the last day of the month (Lingo Form is available digitally from Project Manager).
   2) **Current W-9** – must be on file with Contractor.

   The following *may* also be required as a prerequisite for payment:

   3) **Evidence** – Along with the Lingo Invoicing Form, Subcontractor shall submit a schedule of values for the entire subcontract with each pay application. Additional information may also be required to substantiate invoicing or to comply with requirements for any Incentives being sought by Owner.
   4) **Lien Waivers** - Subcontractor shall provide, in a form satisfactory to the Owner and Contractor, partial lien or claim waivers and affidavits from the Subcontractor and/or its subcontractors and suppliers for the completed Subcontractor's work being invoiced for. Lien waiver may be made conditional upon payment (standard lien waiver forms are available from Project Manager).

   Given that a correct pay application is submitted by the 25th and meets the above prerequisites, progress payments will be made on the 17th day of the following month.

   Retainage in the amount of 10% will be retained from each progress payment.

   Submission for Payment. Pay applications may be sent in the following ways:

   Via Email: In order to efficiently process invoices transmitted via email, please send all invoicing to AccountsPayable@BuildWithLingo.com.

   - *Do not* send invoicing to the PM on the job being invoiced. Invoicing via email that does not follow this process, could cause a delay in receipt of payment from Lingo.

   Via Mail: Sent to the following address:

   Lingo Construction Services, Inc.
   1135 North Robinson Ave.
   Oklahoma City, OK 73103

Attn: Accounts Payable

Other Payment Conditions: Payment received by the Subcontractor shall be used to satisfy the indebtedness owed by the Subcontractor to any person or entity furnishing labor or material for use in performing the Subcontractors work on this project before it is used in any other manner. Subcontractor agrees that Contractor may, at any time, contact any of its subcontractors and/or suppliers to verify amounts paid, amounts invoices or for any other purpose reasonably related to the performance of the work.

Payments Withheld: Contractor is not obligated to make any payment (full or partial) to Subcontractor under the Subcontract if any one or more of the following conditions exists:

a) Subcontractor has failed to perform its obligations under the Subcontract;
b) If any part of such payment is attributable to Work which is not performed in accordance with the Contract Documents;
c) Defects or repetitive issues are detected and not resolved promptly within thirty (30) days upon discovery;
d) Subcontractor has failed to make payments promptly to any of their subcontractors and/or suppliers for which Subcontractor has received payment;
e) Subcontractor has failed to provide the prerequisites for payment as outlined above;
f) Reasonable evidence that the Work of the Subcontractor will not be completed within its scheduled time for completion and that the unpaid balance would not be adequate to cover any actual or liquidated damages for the anticipated delay;
g) Subcontractor has filed for protection relief under applicable Bankruptcy laws or a petition has been filed placing Subcontractor under the protection of Bankruptcy laws and Subcontractor has not (1) notified Contractor that Subcontractor has the necessary capacity and resources to finish the Work and honor the Subcontract and will dismiss such petition and remove itself from bankruptcy protection within 90 days of the filing or (2) affirmed and had the bankruptcy court approve its obligations under this Subcontract to Contractor and evidence Subcontractor's ability to perform this Subcontract to Contractor's reasonable satisfaction; or
h) Subcontractor has failed to provide or maintain required insurance or bonds.

Subcontractor further agrees that the Contractor shall have the right in its own reasonable discretion to issue joint checks to any subcontractor or supplier engaged by Subcontractor.

Final Payment: Final payment, constituting the entire unpaid balance of the contract sum, shall be made by the Contractor to the Subcontractor when:

a) the Subcontractor has fully, properly and timely performed this Agreement except for the Subcontractor's responsibility to correct Work and to satisfy any other requirements, if any, which extend beyond final payment;
b) the Subcontractor has submitted a correct final Application for Payment;
c) the Subcontractor has provided lien waivers and affidavits for itself, its subcontractors and suppliers for the completed Subcontractor's work (as deemed applicable by the project manager or Lingo accounting staff);
d) the Subcontractor has provided a warranty affidavit for its work on the project;
e) the Subcontractor has provided copies of submittals, as built drawings and/or mark-ups, product warranties and product manuals.

If any sub-subcontractor or supplier fails to furnish an acceptable final lien waiver and release of claims to Contractor, Subcontractor shall provide a bond or other satisfactory collateral to Contractor to indemnify Contractor and Owner's property interest against any potential lien or other claims subject to terms in the "Lien Release" section of this contract.

10. Lien Releases. If Subcontractor is paid in accordance with Paragraph 9 and/or any non-payment is due to Subcontractor's unsatisfactory performance or breach of any such provisions contained within this sub-contract, Subcontractor agrees to keep the building or project to which this sub-contract relates free and clear of mechanics liens or other encumbrances arising by his act or contract and shall, at his sole cost and expense, defend against any claim, lien, suit or proceeding that may be presented or filed arising out of and in the course of his performance of this sub-contract.

In such case, if a lien is claimed or filed against the Project or Project funds by any sub-subcontractor, laborer, supplier or other party supplying labor, materials, equipment or services, or other party claiming through or

against Subcontractor, or if a legal action is commenced by such claimants involving the Project, Project funds, Contractor or the Owner, the Subcontractor shall have twenty (20) days from the receipt of notice of said lien within which time to settle the claim and have the lien canceled or to post a bond with sufficient sureties to discharge the same of record. If following said twenty (20) day period, any lien which has been filed of record has not been canceled and no bond has been posted to discharge the same of record, the Contractor shall have the right to discharge or settle any lien claim by any such means as the Contractor in its sole discretion may deem most advantageous, including without limitation the right to withhold an amount equal to the greater of 1.25 times the amount of the lien from any payment otherwise due to the Subcontractor, at the Subcontractor's sole expense, and all costs and damages incurred by the Contractor, including reasonable attorneys' fees and disbursements, shall be paid by the Subcontractor to the Contractor upon written demand, or offset and withheld from any amounts otherwise due and payable to the Subcontractor under this Agreement between the Contractor and Subcontractor. Additionally, in the event Subcontractor files for bankruptcy protection during the course of the job and a lien or pre-lien is filed by a sub-subcontractor or supplier, Contractor shall have the right to pay sub-subcontractors, laborers, suppliers or any other party supplying labor, materials, equipment or services, directly for any amounts in dispute – with the amounts paid being deducted from this Subcontract.

11. Insurance. Subcontractor shall take out and pay for General Liability, Workers Compensation, Business Auto and Umbrella policies.

An insurance certificate shall be provided by Subcontractor prior to commencing work on site and / or receiving first payment showing at least the following coverages and conditions:

A. General Liability insurance of not less than $1,000,000 per occurrence and $2,000,000 aggregate on a per project basis.

B. Workers Compensation Coverage with employer's liability limits of not less than $500,000/$500,000/$500,000

C. Business Auto insurance of not less than $1,000,000 combined single limit of liability.

D. Umbrella policy of not less than $1,000,000 per occurrence and $1,000,000 aggregate

E. Contractor shall be named (address info noted below) as additional insured on a primary and non-contributory basis including completed operations per ISO form CG 2037 or its equivalent. Additionally, Owner may also be requested to be named as additional insured.

Contractor:
Lingo Construction Services, LLC
1135 North Robinson Ave.
OKC, OK 73103

To the fullest extent permitted by law subcontractor agrees to defend, indemnify and hold harmless contractor, owners, architect and engineer, along with their respective officers, agents, servants and employees from all claims, suits, judgments and expenses, including attorney's fees and expenses of litigation, involving economic loss, personal injury, property damage or wrongful death that arise out of or are connected with the Subcontractor's work or presence on the job, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including loss of use resulting therefrom, but only to the extent of the degree of percentage of negligence or fault attributable to the Subcontractor or its agents, representatives, sub-subcontractors or suppliers or anyone directly or indirectly employed by them or anyone for those acts they may be liable. Subcontractor's indemnity obligation shall not include any claim, damage, loss or expense caused by the negligence or fault of party indemnified hereunder.

Builder's Risk insurance may be provided by the Owner or Contractor covering all materials for which the insured shall be liable or shall have assumed liability that becomes a permanent part of the structure or project. It is the responsibility of each Subcontractor to furnish its own coverage for scaffolding, supplies, tools and any other owned/rented equipment not to become part of the structure. Whether or not a loss is reimbursable by builder's risk insurance, each Subcontractor hereby acknowledges its obligation for any loss

to its work and will be responsible for the deductible amount under this policy. Subcontractor assumes the responsibility to purchase any additional or gap insurance it may deem necessary to protect its interest.

Materials stored offsite: For any materials received for the Work, but stored offsite, an insurance certificate is required from the entity in possession of and holding the materials in storage – naming the Contractor and Owner as additional insured.

12. Warranty. This Subcontractor shall repair or pay the reasonable cost of repair for any work previously installed that is damaged by this subcontractor's operation.

Subcontractor warrants, for a period of one (1) year, to the Contractor that all work, materials and equipment furnished or which are furnished by its sub-subcontractors or material men, under this Subcontract shall be new and free from defects, unless otherwise specified, and that all work will be first –class quality and shall be in conformance with the terms and conditions of this Subcontract and the Owner Contract. Subcontractor further warrants that all work will comply with all warranties, guarantees and building requirements which are imposed upon the Owner, Contractor, or Subcontractor by any local ordinances, requirements of city or county building codes or federal or state authorities which are applicable to the work. Subcontractor additionally agrees to repair or replace all Work that may prove defective in workmanship or materials commencing on the date of substantial completion and ending one (1) year from the date of substantial completion and acceptance of the Work by Owner in addition to any requirements to repair or replace defective Work. Such guarantees and warranties shall include the removal and replacement of other work affected thereby and payment for resulting damage to other property.

13. Confidentiality. Except with the prior written consent of Contractor or Owner, Subcontractor agrees that neither Subcontractor nor any of its affiliates, sub-subcontractors, employees, or suppliers will at any time, directly or indirectly use, disclose or disseminate to any other person any confidential information. For purposes hereof, "confidential information" shall mean any nonpublic information (including the substance of any communications whether oral or in paper or electronic form) regarding or relating (directly or indirectly) to any personal, business, social, financial or other activity or interest of the Owner and its affiliates respectively.

14. Termination or Suspension of the Contract.

Termination for Cause. The Contractor may terminate the Contract if the Subcontractor:

1) Refuses or fails to supply enough properly skilled workers or proper materials;
2) fails to make timely payment to sub-subcontractors, employees, and/or suppliers for materials or labor in accordance with their respective agreements;
3) disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
4) is in material breach of a provision of the Contract Documents;
5) breaches any warranty made by the Subcontractor under or pursuant to the Contract Documents;
6) has a voluntary or involuntary bankruptcy case, assignment for the benefit of creditors, receivership or other state, federal or foreign insolvency proceeding commenced with respect to Subcontractor or its properties; or
7) becomes insolvent, is generally not paying its debts as they become due, discontinues business, or commences to dissolve, wind-up or liquidate itself, in whole or in part.

When any of the above reasons exist, the Contractor may, by written notice, demand that the Subcontractor cure the default. If Subcontractor fails to commence and diligently pursue curing the default to the Contractor's or Owner's satisfaction, within three (3) days (seven (7) days in the case of bankruptcy) after receipt of written notice to Subcontractor and Subcontractor's surety, if any, Contractor may without prejudice to any other rights or remedies of the Contractor, terminate employment of the Subcontractor and may, subject to any prior rights of the surety:

1) Exclude the Subcontractor from the site and take possession of all materials;
2) accept assignment of sub-subcontracts;
3) finish the Work by whatever reasonable method(s) the Contractor may deem expedient - with all costs incurred by the Contractor for finishing the Work being the responsibility and liability of the Subcontractor.

When the Contractor terminates the Subcontract for one of the reasons stated above, the Subcontractor shall not be entitled to receive further payment until the Work is finished. The Subcontractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work executed; however, if the unpaid balance of the Contract Sum earned by Subcontractor prior to the termination exceeds the Contractor's costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages and expenses incurred by the Contractor and not expressly waived, such excess shall be paid to the Subcontractor. If such costs and damages exceed the unpaid balance, the Subcontractor shall pay the difference to the Contractor immediately upon written demand.

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

The Contract Sum and Contract Time shall be reasonably adjusted for increases in the actual cost and actual time caused by suspension, delay or interruption if applicable. Adjustment of the Contract Sum, if any, shall include Subcontractor's agreed Fee percentage. No adjustment shall be made to the extent that:

1) performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Subcontractor is responsible; or
2) an equitable adjustment is made or denied under another provision of the Contract.

Termination of the Contract for Convenience

The Contractor may, at any time, upon five (5) days written notice, terminate the Contract for the Contractor's convenience and without cause.

Upon receipt of written notice from the Contractor of such termination for the Contractor's convenience, the Subcontractor shall:

1) cease operations as directed by the Contractor in the notice;
2) take actions necessary, or that the Contractor may direct, for the protection and preservation of the Work; and
3) except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing sub-subcontracts and purchase orders and enter into no further sub-subcontracts and purchase orders.

In case of such termination for the Contractor's convenience, the Subcontractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work executed.

15. Employee Leasing. If Subcontractor is leasing his employees, Contractor will require the following from the Employee Leasing Company:

1. A Certificate of Worker's Compensation Insurance showing a carrier acceptable to Contractor,
2. Certificate of Insurance must include reference and assurance to the satisfaction of Contractor that the Worker's Compensation carrier has endorsed its policy to include a Waiver of Subrogation in favor of Contractor and that the Alternate Employer Endorsement naming Contractor has been added to such Workers Compensation Policy, and
3. Submit proof of drug test information.

16. Labor and Immigration Laws. Subcontractor agrees to comply with all provisions of labor laws and anti-discrimination practices (EEO, ADA, etc.).

The Subcontractor agrees that if any government agency determines that any employee or agent employed by Subcontractor on the Project is not authorized for employment in the United States, then Subcontractor shall indemnify and hold harmless the Owner and Contractor and any of the Contractor and Owner's agents from any liability incurred by Contractor or Owner as a result of such determination. Such indemnification shall include, by way of example but not in any way limited to, any civil or criminal fines or penalties, assessed or alleged, and any costs and expenses incurred in responding to or participating in any government investigation, finding, recommendation, hearing, appeal, or any other proceeding, including attorney's fees. Subcontractor shall require all of its sub-subcontractors and suppliers to comply with all immigration laws and regulations applicable to the Project.

17. **Housekeeping and Tobacco.** Subcontractor shall ***daily*** broom clean and remove excess material and debris, including breakdown and removal, from each work area, and site prior to discontinuing work and at completion – this includes the disposing of all drinks, food, snacks, etc. If, Subcontractor has not diligently proceeded with the cleanup or as directed by Contractor's project management and/or onsite supervisor, the Contractor has the right to proceed with the cleanup work at the Subcontractor's cost and expense of 1.25 times the cost of work to the Contractor.

    No smoking is allowed in the field office, inside project location, or in jobsite trailers. E-cigarettes and/or "vapes" are also not allowed in the same manner. A designated area for smoking may be decided on a project-by-project basis. Failure to abide by this requirement may result in removal of personnel from the jobsite and/or termination of contract.

18. **Communication.**

    Professional Communication. Contractor insists that all Workmen will use proper language that will not be offensive to the Owner, Architect, Contractor, or the Public. Any form of behavior that could be construed as harassment of any type will not be tolerated.

    Electronic Communication. Subcontractor is required to provide the resources necessary to communicate electronically with Contractor and other project members if necessary.

    This project will utilize an online cloud-based construction management software called **Procore** (app.procore.com) for all project documentation. Applicable team members of this Subcontractor will be invited to, and are required to create a Procore username (email) and password if they do not already have one. This Subcontractor will be expected to obtain drawings, RFIs, coordination drawings, etc. via this application. Contractor will notify Subcontractor as relevant items are added. It will be the responsibility of this Subcontractor to regularly check and review updated documents as they are added. Applicable team members of this Subcontractor are required to familiarize his/herself at the following website: https://support.procore.com/procore-learning-paths/subcontractor/vendor-subcontractor and complete a free training certification course within (2) two weeks following subcontract execution. There is ***no cost*** to this Subcontractor for use of Lingo's Procore platform.

    It is recommended that this Subcontractor provide mobile iOS or Android devices with the Procore App installed to at least one individual on-site to provide real-time access to current posted drawings, specifications, RFIs, submittals, project documents, as well as any deficient observations or punch list items. Providing mobile access will improve communication, efficiency, and productivity for all parties.

19. **Project Signage and Use of Project Images.** All signage at the Project that is visible to the general public (other than standard safety, permitting and inspection related signage) as well as use of the Owner and Contractor's name and/or logo by Subcontractor for any purpose is *not allowed* without Contractor and Owner's prior written approval. Subcontractor must also obtain Contractor and Owner's approval to use images or photographs taken of the project for marketing purposes (e.g., use on brochures, website, pamphlets, etc.).

20. **Indemnification.** The Subcontractor shall indemnify Contractor from any liability, expenditure or obligation imposed upon Contractor for fines, penalties, counsel fees, expenses and costs of litigation, together with corrective measures required by reason of acts of commission or omissions by the Subcontractor or the Subcontractor's agents, employees and suppliers with relation to such safety and health standards, as well as any and all claims arising out of any breach of this Subcontract by Subcontractor.

21. **Claims**. For unresolved claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived, the method of resolution shall be litigation, in a court of competent jurisdiction, except that the Contractor, may at its sole option, require that any dispute be submitted to arbitration pursuant to the Construction Industry Rules of the American Arbitration Association as a condition precedent to further dispute resolution. In any arbitration between Subcontractor and Contractor, pretrial discovery shall be allowed to the full extent as permitted by the local rules of civil procedure in the State of Oklahoma.

    In the event of litigation or arbitration of any dispute between Subcontractor and Contractor, the prevailing party shall be awarded attorney's fees, costs of court and other damages as may be permitted by Subcontract

and applicable law. Should an offer of compromise (settlement) be extended before legal proceedings end, the offer will include the award of attorney fees and costs of court to the prevailing party.

Any action for Claim will be sought in the district County of Oklahoma County and legal proceedings (arbitration or litigation proceedings) will be held in Oklahoma City, OK. In the event of any litigation solely between Contractor and Subcontractor, Subcontractor and Contractor agree to waive trial by jury to the extent such waiver is enforceable pursuant to the laws of the State of Oklahoma.

In the event of any dispute involving the Work, Subcontractor must proceed diligently with performance of its Work and must follow any decision by Contractor with respect to the dispute until final resolution. If Subcontractor makes a claim as provided herein, Subcontractor must continue with its Work without interruption, deficiency or delay.

22. Severability. If any clause or provision of this Agreement should be determined to be illegal, invalid, or unenforceable under present or future laws effective during the term of the Agreement, then and in that event, the remainder of the Agreement shall not be affected thereby, and there may be added as part of the Agreement an amended clause or provision that is legal, valid and enforceable.

By providing my signature below, I confirm that I have read and agree to the terms of this Contract.

	Representative **John Does' Contracting**		**Stan Lingo** **Lingo Construction Services, Inc.**
By	_____	By	_____
Title	_____	Title	**President**

LINGO

To: **Subcontractors**

Re: **Contract/Change Order enclosed**

Enclosed are the following documents:

- Pay Application (electronic available upon request at accountspayable@buildwithlingo.com)
- Conditional Lien Waiver and Release (electronic available upon request at accountspayable@buildwithlingo.com)
- Instructions for Conditional Waiver
- Contract
- W-9

In order to serve our clients and subcontractors faster we are moving to DocuSign e-signatures for our contracts. There is no cost to you for this service. Just follow the online instructions on how to accept your signature and initials.

Please complete the DocuSign e-signature as soon as possible so that we may have an executed contract before you begin to turn in your billings.

Please forward all enclosed documents to Accounting and the individual responsible for submitting monthly pay applications. All pay applications, insurance certificates, and W-9s should be sent to accountspayable@buildwithlingo.com. Should you have any questions please e-mail or call me at the contact information below.

Respectfully,

Aja Patterson
Lingo Construction Services
1135 N. Robinson Avenue
Oklahoma City, Oklahoma 73103
405.602.2100 office ext. 100
apatterson@buildwithlingo.com

LiNGO

Application for Payment: Subcontractor

Subcontractor *(company full name):* _____

Contract Number *(number on the top right of Lingo contract):* _____

Pay Request Number *(example; #1, #2, #3, etc.):* _____

Subcontractor Invoice Number *(subcontractor in-house numbering):* _____

Invoice Date *(Provide to Lingo office via fax, email, or hard copy. Hard copy must follow by 1st of the month if faxed):* _____

A.	**Original Contract Amount** *(amount on original contract provided by Lingo):*	$ -
B.	**Total Approved Change Orders** *(amount of written change orders from Lingo):*	$ -
C.	**Current Contract Amount** *(sum of Item A and B):*	$ -
D.	**Completed to Date This Month** *(percent complete *dollar amount*):*	$ -
E.	**Completed to Date Last Month** *(amount from item D on previous pay application):*	$ -
F.	**Current Invoice Amount** *(difference in Item D and E above):*	$ -
G.	**Retainage Amount** *(10% of Item F. for monthly retainage held):*	$ -
H.	**Current Invoice Amount Less Retainage** *(Item F less Item G):*	$ -

Pending Change Order Requests

01.		$ -
02.		$ -
03.		$ -
04.		$ -
05.	*If additional space is required, provide a separate sheet with totals and place in this cell ----->*	$ -
	Total Pending Change Orders	$ -

By signing below, I agree with the above submitted pay application information in it entirety. I have insured stored materials and agree with contract amount and change orders provided by Ling Construction Services:

Signed by: _____ For Subcontractor: _____

In order to efficiently process invoices, please send all invoicing via email to **AccountsPayable@BuildWithLingo.com** or send via mail to: 123 NW 8th Street, OKC, OK 73102, Attn: Accounts Payable

Conditional Lien Waiver and Release on Progress Payment

Subcontractor Company Name: _____

Project Name: _____

In consideration of the Payment Amount of $_____ and for other good and valuable consideration, the sufficiency of which is hereby acknowledged, the undersigned, its agents, representatives, employees, and all those acting on its behalf, do hereby waive, release, and relinquish any and all rights, claims, demands, liens, bond claims, and the like, arising out of the performance of work, the furnishing of labor, or supplying materials by the undersigned through the date of _____ pursuant to an agreement with (general contractor) Lingo Construction Services, Inc. in connection with the construction of the Project, for which the payment has been made.

The undersigned further represents that all of its obligations, legal or otherwise related to or arising out of its work on the Project have been fully paid or satisfied, including, but not limited to, the following: employees, laborers, materialmen, and subcontractors employed by the undersigned; labor, material, equipment, and supplies furnished by others to the undersigned; and sales and use taxes, social security taxes, income tax withholding, unemployment insurance obligations, license fees, and other taxes and obligations imposed by governmental authorities or contract.

The undersigned does hereby agree to indemnify (general contractor) Lingo Construction Services, Inc. and the project Owner its surety, its agents, representatives, and employees and others claiming by or through them for any and all claims, damages, losses, expenses, lien bond removal costs, attorney's fees, and the like incurred by reason of any claim that the undersigned has not fully paid for all labor, material, and expenses incurred in connection with its work on the Project.

Subcontractor: _____ Contact Name _____

Contact Phone # _____ Contact Email _____

Amount Invoiced to Date (***including*** payment amount noted above) $_____

Contract Amount to Date (***including*** current change orders) $_____

With full authority, I have executed this instrument on the _____ day of _____, 20____

Signature: _____

Printed Name: _____

County of _____ §
§
State of _____ §

Sworn to and subscribed before me this

_____day of _____, 20___.

_____
Notary Public

Example of how to fill out a conditional / partial waiver for Lingo Construction

Conditional Lien Waiver and Release on Progress Payment

Subcontractor Company Name: Your company name here

Project Name: Name of project (ask Lingo PM for official name if needed)

Input the amount of the invoice you are submitting (this is the billed amount *less* (-) retainage)

In consideration of the Payment Amount of $_____ and for other good and valuable consideration, the sufficiency of which is hereby acknowledged, the undersigned, its agents, representatives, employees, and all those acting on its behalf, do hereby waive, release, and relinquish any and all rights, claims, demands, liens, bond claims, and the like, arising out of the performance of work, the furnishing of labor, or supplying materials by the undersigned through the date of _____ pursuant to an agreement with (general contractor) Lingo Construction Services, Inc. in connection with the construction of the Project, for which the payment has been made.

The last day of the period covered by the invoice you are submitting

The undersigned further represents that all of its obligations, legal or otherwise related to or arising out of its work on the Project have been fully paid or satisfied, including, but not limited to, the following: employees, laborers, materialmen, and subcontractors employed by the undersigned; labor, material, equipment, and supplies furnished by others to the undersigned; and sales and use taxes, social security taxes, income tax withholding, unemployment insurance obligations, license fees, and other taxes and obligations imposed by governmental authorities or contract.

The undersigned does hereby agree to indemnify (general contractor) Lingo Construction Services, Inc. and the project Owner its surety, its agents, representatives, and employees and others claiming by or through them for any and all claims, damages, losses, expenses, lien bond removal costs, attorney's fees, and the like incurred by reason of any claim that the undersigned has not fully paid for all labor, material, and expenses incurred in connection with its work on the Project.

Subcontractor: Your company name here

Contact Name: Your company contact for the project

Contact Phone #: Your company contact for the project

Contact Email: Your company contact for the project

Amount Invoiced to Date (***including*** payment amount noted above) $_____

Enter the sum of previous amounts billed PLUS (+) the payment amount listed above.

Contract Amount to Date (***including*** current change orders) $_____

Enter your current contract amount with all approved change orders

With full authority, I have executed this instrument on the _____ day of _____, 20___

Enter date info

Signature: Authorized representative who can legally bind the company

Printed Name: The company representative's name

County of _____ §

§

State of _____ §

Sworn to and subscribed before me this

_____day of _____, 20___.

_____

Notary Public

Must be sent with a valid notary signature and seal If you do not have access to a notary, Lingo has several on staff that can assist you.

Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

▶ **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See Specific Instructions on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶ _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ▶

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN,* later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–			–				

or

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here Signature of U.S. person ▶ Date ▶

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9.*

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and

4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting,* later, for further information.

Note: If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.

2. The treaty article addressing the income.

3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.

4. The type and amount of income that qualifies for the exemption from tax.

5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 24% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,

2. You do not certify your TIN when required (see the instructions for Part II for details),

3. The IRS tells the requester that you furnished an incorrect TIN,

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code,* later, and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships,* earlier.

What is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code,* later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to an FFI to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note: ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C corporation, or S corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box on line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3.

IF the entity/person on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation
• Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes.	Individual/sole proprietor or single-member LLC
• LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes.	Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation)
• Partnership	Partnership
• Trust/estate	Trust/estate

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

• Generally, individuals (including sole proprietors) are not exempt from backup withholding.

• Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.

• Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.

• Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)

2—The United States or any of its agencies or instrumentalities

3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

4—A foreign government or any of its political subdivisions, agencies, or instrumentalities

5—A corporation

6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession

7—A futures commission merchant registered with the Commodity Futures Trading Commission

8—A real estate investment trust

9—An entity registered at all times during the tax year under the Investment Company Act of 1940

10—A common trust fund operated by a bank under section 584(a)

11—A financial institution

12—A middleman known in the investment community as a nominee or custodian

13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over $600 required to be reported and direct sales over $5,000[1]	Generally, exempt payees 1 through 5[2]
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

[1] See Form 1099-MISC, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, write NEW at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester,* later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at *www.SSA.gov*. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at *www.irs.gov/Businesses* and clicking on Employer Identification Number (EIN) under Starting a Business. Go to *www.irs.gov/Forms* to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to *www.irs.gov/OrderForms* to place an order and have Form W-7 and/or SS-4 mailed to you within 10 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code,* earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account) other than an account maintained by an FFI	The actual owner of the account or, if combined funds, the first individual on the account[1]
3. Two or more U.S. persons (joint account maintained by an FFI)	Each holder of the account
4. Custodial account of a minor (Uniform Gift to Minors Act)	The minor[2]
5. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law	The grantor-trustee[1] The actual owner[1]
6. Sole proprietorship or disregarded entity owned by an individual	The owner[3]
7. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	**Give name and EIN of:**
8. Disregarded entity not owned by an individual	The owner
9. A valid trust, estate, or pension trust	Legal entity[4]
10. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
11. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
12. Partnership or multi-member LLC	The partnership
13. A broker or registered nominee	The broker or nominee
14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
15. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

[4] List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships*, earlier.

***Note:** The grantor also must provide a Form W-9 to trustee of trust.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to *phishing@irs.gov*. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at *spam@uce.gov* or report them at *www.ftc.gov/complaint*. You can contact the FTC at *www.ftc.gov/idtheft* or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see *www.IdentityTheft.gov* and Pub. 5027.

Visit *www.irs.gov/IdentityTheft* to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

Section 00 4200
Final Payment Affidavit

State of _____)

) SS.

County of _____)

The undersigned, being first duly sworn, testifies as follows:

That Affiant is the _____ of _____
(officer) (Company)
And that in signing and delivery of this affidavit he is acting for and on the behalf of said company.
That said company is the Trade Contractor engage in the construction of:

_____
(Project Name)

_____
(Project Location)

For the Awarding Public Agency of the State of Oklahoma (Owner) pursuant to a written contract entered into with the Awarding Public Agency (Owner). That the construction of said Project has been fully and finally completed in accordance with the written Contract, and all amendments thereto, if any. The company represents that there are no existing judgments, claims, accounts, liens, or other similar type of obligations outstanding and unpaid arising under said Contract or from labor or materials having been furnished for or delivered to said Project. Further, the company represents that all persons or entities furnishing labor or materials used in said Project, or under said Contract, have been paid in full.

_____
(contractor or supplier) (signature)

Subscribed and sworn to before me this

_____ Day of _____, 20_____.

_____

Notary Public
My commission number: _____

My commission expires: _____

CERTIFICATE OF APPROVAL

The undersigned, agent or Attorney-in-fact for _____, Surety Company, acting for and on behalf of said Surety Company, acknowledges having seen the above affidavit executed by _____ further that the undersigned hereby approves the affidavit and directs that the Owner of said project is hereby authorized to make final payment under the contract to the Trade Contractor.

Surety Company specifically releases the Awarding Public Agency of the State of Oklahoma (Owner) from any responsibility should any unpaid accounts or claims arise against contractor for labor or material furnished under said Contract or delivered and used in said Project.

_____

(Attorney-In-Fact for Surety Company)

(Attach a Certified Copy of Power-Of-Attorney)

CERTIFICATION OF ASBESTOS FREE CONSTRUCTION

State of _____)

) SS.

County of _____)

_____ (contractor) hereby certifies that no asbestos containing material has been or will be furnished or installed by their employees or subcontractor's working on their behalf at Canadian County Public Facilities Authority.

_____

(contractor or supplier) (signature)

Subscribed and sworn to before me this

_____ Day of _____, 20_____.

_____

Notary Public

My commission number: _____

My commission expires: _____

Section 00 4400

Special Conditions of the Subcontract

1. **GENERAL:**
   A. The Final Completion date for the Canadian County Expo Center will be **July 30th, 2021.**
   B. Project site is located at 3001 Jensen Road East, El Reno, OK 73036.
   C. Subcontractors will be required to attend preconstruction meetings, progress meetings, and other meetings to review the Project. Items to be discussed during the progress meetings shall include, but are not limited to, safety, schedule, RFI's, coordination issues, and changes to the work.
2. **PROJECT CORRESPONDENCE:**
   A. Project Correspondence will occur electronically through e-mail and project management software. This will include payment applications, RFI's and submittal distribution, change requests, meeting minutes, schedules and other general correspondence. Subcontractors must maintain an active e-mail address to receive project correspondence.
3. **PRE-INSTALLATION**
   A. At CM's discretion and as a required in the Project Specifications preinstallation meetings will be held at the project site prior beginning work. Subcontractors onsite foreman, project manager, and material suppliers if required by CM will be in attendance.
4. **SUBMITTALS AND RECORD DOCUMENTS**
   A. Refer to Division 01, subcontractor is required to provide project specific, organized and complete submittals for expedient and efficient review. Submittal not meeting this requirement will result in rejection for resubmittal.
5. **PAYMENT PROCEDURES**
   A. Within 15 days of award of contract subcontractor shall submit a Schedule of Values for approval by the CM. Schedule of Values to include individual line items for each major category of its work. Dollar amounts to include all, labor, material, overhead and profit.
   B. Payment for Application to be submitted electronically on the **20th of each month,** payment applications received after the 20th of each month will be not be processed until the following month.
6. **SAFETY**
   A. The Subcontractor shall be responsible for compliance with all safety rules and regulations under the Occupational Safety and Health Act and other pertinent statutes and ordinances in connection with the work performed by the Subcontractor. Subcontractor will also abide by any site specific or hazardous material safety measures as requested and deemed necessary by Contractor's management and/or field supervision.
7. **PERMITS TESTING COSTS AND OTHER FEES**
   A. Subcontractor shall obtain and pay for all other applicable permits, assessments, bonds, licenses, fee and certificates of inspection necessary to perform the work of this subcontract.
   B. The Owner will pay for tests as required by the technical sections of the specifications. Costs associated with failed tests and retest fees will be the responsible of the subcontractor.

Trade Package Scopes of Work

The following Trade Packages describe the scope of work to be included in each bid package. Bids shall include all items listed in the General Bid Package as well as the individual bid package relative to your trade and listed below:

1. Bid Package 1 (Bid Date 2/24/2020) (**Items already awarded**)
    a. Trade Package 02-1 Earthwork, Haul-off, and Erosion Control
    b. Trade Package 05-1a Pre-Engineered Metal Buildings Supply
    c. Trade Package 05-1b Pre-Engineered Metal Buildings Erection
    d. Trade Package 05-1c Pre-Engineered Metal Buildings Supply & Erection

2. Bid Package 2 (**Bid Date 05/07/2020**)

a. Trade Package 2-2: Site Utilities
b. Trade Package 2-3: Fences and Gates
c. Trade Package 2-4: Paving & Site Concrete
d. Trade Package 2-5: Concrete Pavers
e. Trade Package 2-6: Landscaping & Irrigation
f. Trade Package 2-7: Equine Protective Surface System
g. Trade Package 3-1: Structural Concrete
h. Trade Package 3-2: Polished Concrete Floors & Sealer
i. Trade Package 4-1: Masonry
j. Trade Package 5-1a: Structural Steel Fabrication
k. Trade Package 5-1b: Structural Steel Erection
l. Trade Package 5-1c: Structural Steel Supply and Erection
m. Trade Package 6-1: Millwork
n. Trade Package 7-1 Waterproofing
o. Trade Package 7-2: TPO Roofing
p. Trade Package 7-3 EIFS
q. Trade Package 8-1: Glass & Glazing
r. Trade Package 8-2: Doors, Frames, & Hardware
s. Trade Package 8-3: Coiling and Sectional Doors
t. Trade Package 9-1 Cold Form Framing & Drywall
u. Trade Package 9-2: Tape, Bed, Paint
v. Trade Package 9-3: Flooring & Tile
w. Trade Package 9-4: Resinous Flooring
x. Trade Package 10-1: Specialties Supply
y. Trade Package 10-2: Misc. & Install
z. Trade Package 10-3: Graphics & Signage
aa. Trade Package 10-4 Prefabricated Metal Canopies
bb. Trade Package 15-1: Fire Suppression
cc. Trade Package 15-2: Mechanical
dd. Trade Package 15-3: Plumbing
ee. Trade Package 16-1: Electrical & Fire Alarm

Should any bidder be unclear as to the work associated with the General Trade Package or the individual Trade Packages they are directed to contact the Construction Manager.

General Trade Package

A. Trade Contractor has visited and carefully studied the site conditions above and below grade which may affect cost, progress or performance of the work and/or means, methods, techniques, sequences and procedures of construction expressly required by the bidding documents to be employed by the Trade Contractor and considerations are included in the bid.
B. The bidding documents are generally sufficient to indicate and convey understanding of all the terms and conditions for the work performance of the work for which this bid is submitted. The Trade Contractor acknowledges the more stringent requirements should a conflict between the Construction Documents, building code and requirements and manufacturer's recommendation arises without compromising design intent.
C. Provide bonds and insurance per the bidding requirements.
D. Trade Contractor assumes all risk of any and all price increases associated with the cost of their work. Examples of this are material price escalation, lack of availability of materials, labor shortages, etc.
E. Trade Contractor has given Lingo Construction written notice of all conflicts, errors, ambiguities or discrepancies that the Trade Contractor has discovered in the Bidding Documents and the written resolution by the Architect or Engineer is acceptable to the Trade Contractor.
F. Lay down and storage space will be available in designated locations at times approved by Construction Manager. Scheduling the delivery of materials, including the hauling and hoisting of any such items required for this scope of work will be the sole responsibility of the Trade Contractor. Space required for preparation and installation will be coordinated with Construction Manager.
G. Construction Manager or Owner will provide Builder's Risk Insurance. Deductibles shall be the responsibility of the Trade Contractor if the event was a result of the Trade Contractors failure to secure, store, or protect from loss.
H. Each individual Trade Contractor is responsible for all means of access to complete the specified work. This includes any scaffolding, lifts, booms, related engineering, etc. to reach all required areas or facades of the building. Access plans shall be submitted to and coordinated with Construction Manager. Access equipment shall not impose loading to the structure greater than that of the design loading indicated by the Construction Documents. For all elevated decks, the Trade Contractor shall submit signed and sealed calculations showing loading of the Trade Contractor's selected access equipment on the existing structure. The Trade Contractor shall be responsible for engineering costs associated with determining the loading of the access equipment on the structure. The access equipment loading (with appropriate factors of safety) shall not exceed design loading. Where structure is not capable of supporting proposed access equipment, the Trade Contractor shall either use alternate acceptable equipment or shall provide load distribution systems to support loading to acceptable structure. Trade Contractor shall be responsible for installation and removal of such distribution systems unless coordinated otherwise with CM.
I. Safety
    a. Basic Personal Protective Equipment (PPE) including hard hats, safety glasses and vests, is required at all times while on the project site.

b. Trade Contractor is fully responsible for ensuring that employees are competent and certified to operate any tools/equipment needed or used.
c. Trade Contractor is responsible for immediately repairing any safety rails or guardrails removed or damaged as a result of their respective work.
d. Trade Contractor shall have onsite MSDS folder prior to mobilization. Folder may be stored in CM office or in Trade Contractor designated location but location must be coordinated with CM.

J. Regular operating hours are 7:00 am to 3:30 pm Monday thru Friday. Work can take place at off times if approved by C.M. in advance. Trade Contractor shall provide written request for approval 48 hours before proposed work time.

K. Revisions in the planned schedule are intrinsic with the nature of construction. Trade Contractors acknowledge that the Owner and Construction Manager cannot guarantee work will commence on a certain date or continue without interruption. Trade Contractor has included all costs associate with this risk.

L. Trade Contractor will provide adequate labor to carry out and/or complete the scope of work in the scheduled time and will not be eligible for compensation for excess hours or overtime worked to meet the schedule. If an expedited schedule is requested compensation will be negotiated prior to initiation. Trade Contractor further agrees to cooperate and work harmoniously with other trades in achieving completion dates, and to coordinate the work to avoid compression (to the extent possible) for the benefit of all trades.

M. Trade Contractors shall sequence their work to coincide with the Construction Manager's Project Schedule. The subcontractor shall demobilize/remobilize as necessary due to the sequence of construction activities.

N. Trade Contractors will be required to coordinate with Construction Manager as well as other Trade Contractors. If any conflict occurs, immediately notify Construction Manager.

O. Trade Contractor is responsible for coordination of testing for the Trade Contractor's work in accordance with the Construction Documents as well as local code and city requirements.

P. The Trade Contractor will send a competent field supervisor with the authority to make decisions on behalf of the Trade Contractor to project coordination meetings prior to beginning the Trade Contractors work, during and after completion of the work as required for the coordination of the project. In addition, the Trade Contractor will maintain, at all times, a suitably sized and skilled crew to proceed rapidly and logically through the work per the direction of the Construction Manager and the amended and published Project Schedule.

Q. A dedicated project Superintendent will be identified for dissemination of jobsite communication between Lingo and Trade Contractor's field personnel.

R. Trade Contractor starting work will be considered acceptance of the substrate or previous work.

S. Construction Manager or Owner will pay for third party testing. Trade Contractors are responsible for coordination of testing, through the Construction Manager. Proper notice must be given to ensure availability of the testing company. Reinspection fee's shall be the responsibility of the Trade Contractor who failed the inspection. Costs associated with delays due to lack of coordination between Trade Contractor and testing agency shall be the responsibility of the Trade Contractor.

T. All layout, product submittals, mockups, field measurements, coordination with other trades, fees, inspections, tests and certificates as required by law or jurisdictional oversight will be paid by those specific Trade Contractors.

U. Prior to establishing building pad elevation Construction Manager will provide benchmark elevations. All additional layout, elevations, grade stakes, and surveying required are the responsibility of the Trade Contractor.

V. Surveying control points will be provided by the Construction Manager after building pad elevation is established. All additional layout, elevations, grade stakes, and surveying required are the responsibility of the Trade Contractor.

W. Trade Contractor is responsible for providing dewatering and pumping necessary to complete their scope of work.

X. Electronic copies of shop drawings and submittals must be provided to the Construction Manager within fifteen (15) days of the Trade Contractor receiving the Notice To Proceed or as approved by the Construction Manager.

Y. Trade Contractors are responsible for ensuring their materials are delivered to the project at a time that coincides with the project schedule.

Z. Trade Contractors are responsible for protecting cast in place concrete (to remain exposed) against markings. Examples of markings include tire marks from equipment as well as chalk lines that are not removeable. Trade Contractor shall be responsible for all costs associated with removal of such markings if they occur.

AA. Trade Contractors are responsible for taking precautions to protect their work as well as adjacent property (such as utilities, city roads & streets, private property, etc.).

BB. Trade Contractors shall provide drinking water for their employee's.

CC. Trade Contractor's shall have a foreman capable of speaking fluent English and translating for any non-English speaking personnel on their crew.

DD. Instructions of Owner's Personnel on operation of systems and startup of systems as detailed in the Contract Documents are included. Provide electronic files of all operation and maintenance manuals, warranties, as-built drawings and any other closeout documentation. Trade Contractor to include cutting, sealing and patching (including fire caulking) of all penetrations relating to the work made by that Trade Contractor. All patching activities for a uniform acceptable finish are included. Trade Contractor to submit proposed fire stop materials to Construction Manager for review prior to installation.

EE. Extra items, requested by Lingo or the Owner, will have a markup not to exceed 10% of labor and material cost. A fully detailed breakdown including, however not limited to labor, materials, equipment and incidentals will be required for any additional work. All requests for change order pricing must be turned in within 3 working days of the request for a price unless coordinated otherwise.

FF. All specifications (including Divisions 00 and 01) are part of this bid package.

GG. Submit written daily activity reports to Lingo's Superintendent by 3:00pm daily.

HH. All trash and debris resulting from Trade Contractor's work shall be daily cleaned up, broken down, and placed in the dumpster (provided by Lingo) by the Trade Contractor. Any material not acceptable to the local landfill or roll off provided will be removed from the site and legally disposed of by the

Trade Contractor. Trade Contractors are responsible for maintaining a safe, clean, uncluttered workplace.

II. Trade Contractors are required to provide copies of inspection tags to the Construction Manager immediately following inspections.

JJ. Closeout Procedures – The following are required in order to expedite closing the job out and applying for retainage
    a. Closeout documents (O&M manuals, warranties, training, etc) will be requested approximately ninety (90) days prior to substantial completion.
    b. Start dates on warranties shall read “From the Date of Substantial Completion” in lieu of a specific date.
    c. A certificate will be issued, included in the warranty manual and distributed to the trade contractors, with the actual date of substantial completion.

KK. Trade Contractors are responsible for providing task lighting as necessary to perform their work.

LL. Trade Contractors to remove their spoils from underground work from site. Trade Contractor to backfill their underground work per the geotechnical report recommendations.

MM. Concrete Penetrations, Sleeves, & Sawcutting
    a. Trade Contractors are responsible for identifying, locating, and ensuring blockouts and penetrations are incorporated into concrete pours such that their work can be installed properly.
    b. For openings in concrete walls or slabs not specifically detailed in Contract Documents Trade Contractor requiring the opening shall be responsible for blockouts or void forms.
    c. Trade Contractors shall provide supervision at concrete pours involving penetrations and sleeves associated with their work.
    d. In the event concrete sleeves or blockouts are not identified, located, or placed properly the Trade Contractor requiring the opening shall be responsible for the full cost of demolition, removal, and replacement of all concrete required for the installation of their work. Costs shall include removal of material off site, testing of new material as required, and all reinforcement, vapor barrier, and finished necessary to install blockout.
    e. Saw cutting and patching are the responsibility of the Trade Contractor who requires the work.
    f. Trade Contractors to submit core drilling and/or sawcutting locations & sizes to the Construction Manager for approval by the EOR prior to proceeding with work. Where Construction Manager/EOR require scanning or locating of cast in reinforcement, the Trade Contractor shall be responsible for these costs.

NN. Warranty period shall start at the date of substantial completion.

OO. Trade Contractors shall provide their own flagmen and traffic control as necessary for their scope of work as well as deliveries.

PP. For trades requiring inspections partial inspections shall be included in the cost of work.

QQ. Trade Contractors shall be responsible for providing their own GFCI protection if using permanent power from the building.

RR. Provide any temporary lighting required to complete work. Construction Manager will only supply minimum required by OSHA.

SS. All Trade Contractors shall submit their company safety policy, identified competent person, and any job specific job hazard safety documents to CM prior to start of work. This does not relieve the Trade Contractor from responsibility of implementing their own safety policy but is used to promote a more comprehensive safety environment on the project.

TT. Project shall be tax exempt. Trade Contractor shall take this into account for material that is to remain onsite only. Temporary materials that do not remain as a part of the structure cannot be considered for tax exempt status. Refer to local rules/regulations for more information.

UU. Clarification: Refer to bonding requirements listed on bid form 00 2000 in specifications for information about requirements.

VV. Trade Contractors will not be compensated for time or money due to rework items not correctly installed or not meeting QC requirements. Trade Contractor shall be required to review trade specific work as completed to ensure it meets specification requirements.

Bid Package 01

Trade Package 2-1: Excavation, Haul-off, and Erosion Control

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Excavation, Haul-off, and Erosion Control** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Section 31 1000	Site Clearing
Section 31 2000	Earth Moving

Quantity Check: On Section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- CY of cut
- CY of fill
- CY of export
- Duration for building pad and pavement preparation (working days)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Provide additional mobilization for backfilling against curbs, final grade at areas shown and distributing topsoil.
- Milestones:
    - Project Scheduled Start: 3/23/2020
    - Building Pads complete: 4/17/2020
    - Site Grading Complete for Paving Start: 6/1/2020

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. While on site ensure public streets remain clean from any mud or debris tracked out of jobsite. During earthwork activities when necessary due to water, excavation contractor to provide power washer and attendant to clean mud off tires of vehicles existing jobsite. Further, excavation contractor to provide street sweeper and operators as necessary to maintain clean streets. If vacuum tracks or

steam cleaning required, due to earthwork activities, it shall be at the expense of the earthwork Trade Contractor. To reduce dust and spillage, truck beds must be covered and rims of truck beds swept upon exiting jobsite.

3. Provide dust control per governing authorities and as required by the Construction Manager throughout this scope of work by this Trade Package.
4. Protect all items noted to remain that are in or adjacent to the work zone.
5. Prepare site and building pad and grade/compact per evaluations and recommendations provided in the geotechnical report included in the project manual.
6. Verify locations and protect all utilities prior to and during work. Trade Contractors are responsible for calling in and maintaining locates adjacent to their work.
7. Include temporary hydrant meter and water trucks for any water required to complete the work in this bid package.

Demo and Clearing

8. This Trade Package to provide their own haul off of demo'd or cleared material. Dumpsters will not be provided by Construction Manager.
9. This Trade Package shall be responsible for removal of natural materials, vegetation, and trees. Additionally, will be responsible for removal of surface and subsurface gravel drives, pavement, abandoned pipe, conduit, wire, etc. from the existing site/structures where interference with grading occurs. The utility contractor will be responsible for cutting and capping the existing utilities as shown in the contract documents.
10. This Trade Package shall be responsible for removal of barbed wire fence as noted on demolition plan. Fence shall be removed at completion of earthwork scope or as coordinate with CM.
11. This Trade Package shall be responsible for the removal of existing culverts and cattle guards as noted on demolition plans. Removal timeline to be coordinated with CM.
12. When trees are removed the entire tree, including stump and roots, is to be removed.
13. Clear and grub obstructions, shrubs, trees, and other vegetation within footprint of building as well as areas where exterior paving or improvements occur.
14. Include generators if electricity is required for work in this package.
15. Construction Entrance – Provide rock construction entrance with filter fabric underneath at the east end of project at location directed by CM. Provide culvert +/-25' for entrance. Near the east entrance provide additional 1800 sf (30'X60' approx.) gravel area with filter fabric for use as a wheel wash/mud removal station. Maintain construction entrances throughout work associated with the Earthwork Trade Package.

Erosion Control

16. Erosion control equipment and devices shown on plans will be provided and installed by this Trade Package. Inspections and maintenance are not included in this Trade Package.

17. This Trade Package to provide silt fencing for stockpiles of topsoil as well as berms not specifically shown on the drawings. In addition, this Trade Package to include erosion control required for earthwork activities due to sequencing of temporary stockpiles that is not shown on the plans.
18. Rip rap at storm drain shall be provided and installed by this trade package at time of final grading. Temporary discharge erosion control measures shall be installed by this trade package.
19. Provide and install all erosion control shown on the Construction Documents.
20. Include all rock dams, rock dikes, filter fabric, silt fencing and all other erosion control measures shown and referenced in the specification.
21. Provide temporary inlet and outlet protection.
22. Removal of erosion control items is included in this Trade Package.
23. Provide silt fence around perimeter of construction entrances and wash off areas.

Grading

24. At areas, under the building pad, receiving greater than 10' of fill provide crushed stone or gravel per Section 5 Evaluations & Recommendations in the Geotechnical Report.
25. Because of the depth of fill at large portions of the slab on grade it is critical that positive drainage be provided away from the fill to avoid excess water being directed into the fill. Trade Contractor shall be liable for removal/replacement if fill becomes saturated due to negligence.
26. Supply and installation of granular backfill at retaining walls or under building pads as directed by Geotechnical report, specifications, or construction documents. Slab on grade sub-base as specified in structural drawings shall be by concrete subcontractor and not this Trade Package.
27. Strip and stockpile all topsoil on site to areas designated by the site superintendent. Provide stabilization of stockpiles as necessary to prevent wind and water erosion. Provide and install silt fencing around stockpiles.
28. Provide dewatering as required to perform the work in this bid package.
29. Provide all importation, placement, compaction of select fill material required to establish finish grades per the Contract Documents and geotechnical report. Provide acceptable fill material or treat existing material so that it will meet the requirements of the Contract Documents.
30. This Trade Package shall include proof rolling and watering as required to meet specified compaction and moisture requirements.
31. Concrete Trade Contractor to provide and install gravel base at building pad. Earthwork contractor to prepare subgrade to elevation corresponding with the bottom of aggregate base. Carry building pad 5' beyond perimeter of building pad unless obstructed by retaining walls.
32. Final grading and compacting of subbase material to within +/- 1 ¼ (.10) of the specified elevations. This +/- requirement shall be balanced to zero. Provide positive drainage away from building pads. Notify site superintendent if this is not possible.
33. Protect survey control points by marking them clearly. Earthwork Trade Contractor shall be responsible for costs associated with replacing control points, unless caused by another trade.
34. Scarifying and re-compaction as required.
35. At the floor slab overcut and recompaction may be required. Trade Contractor to include over excavation and fill/compaction with suitable soil as directed by the Geotechnical Report.

36. Stockpile and spread topsoil for areas to receive sod. Landscape Trade Contractor to provide and install topsoil for beds.
37. Earthwork Trade Contractor to backfill against curbs and paving.
38. Earthwork operation over existing onsite utility lines should be limited according to the stipulations outlined on sheet C6-0. Note existing pothole over "Centurion" owned 16" pipelines indicated 2'-0" +/- from existing grade. Trade Contractor shall be required to have a roadway of minimum 4'-0" fill over top of pipeline when crossing perpendicular.

Alternates:

39. Alternate 01 shall be for Grading out Stall Barn as indicated on the Construction Documents.
    a. Trade Package 01: Earthwork, Haul-off, and Erosion Control: Base Bid Shall include cost of Stall Barn building pad preparation according to geotechnical report and Construction Documents. Alternate 01 price shall be to overlay Base-Bid Stall Barn building pad with 8" topsoil.
40. Alternate 02: Trade Contractor to provide an Add Alternate for a per sf price for 4" thick crusher run construction parking lot applied over filter fabric at location specified by CM onsite.
41. Alternate 03: Trade Contractor to provide an Add Alternate for 18" RCP Storm Line 2 noted on north east permanent site entrance installation. Trade Contractor shall indicate "Excluded" for exclusion of this alternate.
42. Alternate 04: Building Owner to provide, spread, and compact gravel parking areas under base bid. This Trade Contract shall not include gravel drives or parking as indicated in documents as a portion of the base bid. This Trade Contract shall include add alternate cost of supplying, spreading, and compacting gravel as indicated in drawings as a part of Alternate #04.
43. Alternate 05: The most recent report includes soils test pits to verify that existing soils can be modified with hydrated lime to be utilized for select fill. Imported select fill should be priced as the base bid. Trade Package 02-1 Alternate 05 shall be to use existing onsite soils, improved to meet requirements outlined in geotechnical report.

Trade Package 5-1a: Pre-Engineered Metal Building Structures Supply

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Pre-Engineered Metal Building Structures** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 13 3419	Metal Building Systems

Quantity Check: On Section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total tonnage of fabricated steel/connections/stiffeners etc. (tons)
- Lead time to produce shop drawings for Anchor Bolts from date of release (days)
- Lead time to deliver anchor bolts from receipt of approved shop drawings. (days)
- Duration for shop drawings (weeks)
- Duration for fabrication/delivery from approved shop drawings (weeks)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Submittals due to CM:
  - Anchor Bolt Shop Drawings: 6 weeks after Notice to Proceed
  - PEMB Shop Drawings (Expo Hall): 6 weeks after Notice to Proceed
  - PEMB Shop Drawings: Remaining buildings: 8 weeks after Notice to Proceed.
  - PEMB Expo Arena – Delivery to Site: 12 weeks from approved shop drawings
  - PEMB Remaining – Delivery to Site : 14 weeks from approved shop drawings

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. The Pre-Engineered Metal Building fabricator shall be responsible for providing shop drawings, connection design, fabrication, and delivery of the following items: Pre-Engineered Metal Building Anchor Bolts, Frames, Purlins, Bracing, Miscellaneous Steel, Associated fasteners, Embeds, Roof Decking, bearing plates, miscellaneous steel typically required, and Metal deck panels on interior and exterior of building as shown on the architectural and structural plans.
3. Provide design, engineering, and Oklahoma licensed professional engineer's seal for all connection calculations that are not shown in the contract documents.
4. Provide shop-made steel templates for each set of anchor bolts.

5. Provide primer at all steel that is to receive primer or paint.
6. Galvanize steel as noted on the Contract Documents for items provided by this Trade Package.
7. Provide mechanical unit support framing for units supported by Pre-Engineered Metal Building Structures.
8. Provide all fasteners (bolts, nuts, washers, tension control fasteners, anchors, and epoxy adhesives) necessary to complete installation for the items provided in this Trade Package.
9. Provide and remove all temporary bracing and shoring as required for stability during erection.
10. All exposed steel members to be treated and fabricated as architectural steel.
11. Provide shop visual and non-destructive testing as noted in the contract documents or required by Building Code.
12. On the bid form indicate Yes/No for Certified Fabricator as required per specification. If the answer is no, the Fabricator shall include the cost for the "In Plan Inspections" associated with the special inspections requirements of the IBC.
13. Deliveries to be scheduled and sequenced in coordination with the Site Superintendent and Erector.
14. Provide camber on framing as indicated by Contract Documents.
15. Install steel for roof openings, penetrations, supports, etc. located in Pre-Engineered Metal Building Structures.
16. Provide metal decking and all decking accessories for the project. This Trade Contract shall include metal decking over non-pre-engineered metal building structures. Trade Contract shall include flashings, fasteners, and other items typically required.
17. Dewater of column blockouts while performing work in this Trade Package.
18. Provide temporary perimeter fall protection/guardrail systems required for erection of this work. Temporary protection shall not be welded to exposed structure. Removal by erector.
19. This Trade Package shall be responsible for shipping. Receive, offload, stage, inventory, layout, and install all Pre-Engineered Structure, metal decking, metal decking accessories, and misc. steel associated with this Trade Package shall be by the Pre-Engineered Metal Building Erector.
20. This Trade Package shall include interior insulation at Metal Building structures. This shall include any accessories needed for installation of such system.
21. This Trade Package shall not be responsible for glazing/louvers in Pre-engineered structures but shall provide openings with opening framing as directed by Contract Documents and typical details required for such installation.
22. Anchor bolt templates shall be by the PEMB Supply Trade Package. Templates shall include minimum (1) template per layout type. When the same layout is used for multiple instances, supplier shall provide (1) template for each instance up to a maximum of (5) templates of the same layout pattern.
23. **Liquidated Damages:** Subcontractor acknowledges and agrees that if it fails to complete the Work on or before the applicable Trade Contract Milestone date, Contractor will sustain damages and loss as a result of such failure and such damages will be assessed to the Contractor by the Owner. Subcontractor agrees to be liable to Contractor for liquidated damages for each calendar day of delay in achieving Trade Contract Milestone date in the amount of two hundred fifty dollars ($250) per day. Contractor and Subcontractor agree that these liquidated damages are reasonable in light of the actual or anticipated damages and harm caused by a delay in achieving Trade Contract Milestone date. Trade Contract Milestone Dates are indicated above in "Schedule".

Alternates:

24. Alternate 01 shall be for including Stall Barn as indicated on the Construction Documents.

a. Trade Package 05-1a: Pre-Engineered Metal Building Structures Supply: Base Bid Shall not include cost of Stall Barn. Alternate 01 price shall be to include Stall Barn with framing, decking, accessories indicated. Alternate 01 Stall Barn shall be with all framing primed. Epoxy Painting all Stall Barn to be included in Painting Scope of work.

25. Alternate 02 shall be for including Stall Barn as indicated on the Construction Documents with galvanized framing.
    a. Trade Package 05-1a: Pre-Engineered Metal Building Structures Supply: Base Bid Shall not include cost of Stall Barn. Alternate 02 price shall be to include Stall Barn with framing, decking, accessories indicated. Alternate 02 Stall Barn shall be with all framing galvanized as indicated by specifications.

26. Alternate 03 shall be for including galvanized secondary framing for Pre-Engineered Metal Buildings except for maintenance building and Alternate 01/02 Stall Barn.
    a. Trade Package 05-1a: Pre-Engineered Metal Building Structures Supply: Base Bid Price shall be for primed Pre-Engineered Metal Buildings. Alternate 03 shall be for galvanizing all secondary metal building framing.
27. Alternate 04 shall be for including galvanized Primary and secondary framing for Pre-Engineered Metal Buildings except for maintenance building and Alternate 01/02 Stall Barn.
    a. Trade Package 05-1a: Pre-Engineered Metal Building Structures Supply: Base Bid Price shall be for primed Pre-Engineered Metal Buildings. Alternate 04 shall be for galvanizing all Primary and Secondary metal building framing.

Trade Package 5-1b: Pre-Engineered Metal Building Structures Erection

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Pre-Engineered Metal Building Structures** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 13 3419	Metal Building Systems

Quantity Check: On Section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total tonnage of erected steel. (tons)
- Duration for erection (weeks)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Milestones:
  - Area D (Expo Hall) PEMB Frame Erection – 20 days
  - Area D (Expo Hall) PEMB Standing Seam Roof, Veneer, and Simple Saver Erection – 20 days
  - Area B/C (Arena) PEMB Frame Erection – 30 days
  - Area B/C (Arena) PEMB Standing Seam Roof, Veneer, and Simple Saver Erection – 25 days
  - Area E (Maintenance) PEMB Frame Erection – 10 days
  - Area E (Maintenance) PEMB Standing Seam Roof, Veneer, and Simple Saver Erection – 10 days
  - Area F (Alt. 1 – Stall Barn) PEMB Frame & Roof Paneling Erection – 20 days

Milestones:

- Durations for Frame Erection activities listed above start at the time that both PEMB Material is delivered to site and slab on grade has reached adequate strength.
- Durations for Standing Seam Roof, Veneer, and Simple Saver Erection activities listed above start at the time that MEP hanger install is complete to receive Simple Saver.
- Milestone for Frame Erection indicates that all primary and secondary framing are installed and have passed third party inspections. Structure shall be required to be plumb, self supporting, permanent bracing installed, safe for other trades to occupy, and ready for succeeding work.

- Milestone for Standing Seam Roof, Veneer, and Simple Saver Erection indicates that structure is complete. Structure is watertight at wall sections except at locations for openings to be filled by other trades such as door, window, or MEP trades. Simple Saver system shall be installed and ready for MEP overhead hanger and piping to occur.

Note: Trade Contractor is not scheduled to erect primary and secondary PEMB Framing at the same time in two different structures. However, failure to meet durations above may require Trade Contractor to require multiple Frame erection crews in multiple structures. Trade Contractor will be required to be erecting primary and secondary framing in one area while installing metal panel roof, veneer, or simple saver insulation in the other area. Trade Contractor shall allow for MEP hanger install on PEMB structure prior to install of simple saver system. Trade Contractor shall coordinate this hanger install time with CM and other Trade Contractors.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. The Pre-Engineered Metal Building fabricator shall be responsible for providing shop drawings, connection design, fabrication, and delivery of the following items: Pre-Engineered Metal Building Anchor Bolts, Frames, Purlins, Bracing, Miscellaneous Steel, Associated fasteners, Embeds, Roof Decking, bearing plates, miscellaneous steel typically required, and Metal deck panels on interior and exterior of building as shown on the architectural and structural plans.
3. Unload, Inventory, and Install of all items/material provided by the Pre-Engineered Metal Building Supplier (Trade Package #5-1a).
4. Install mechanical unit support framing for units supported by Pre-Engineered Metal Building Structures.
5. Provide and remove all temporary bracing and shoring as required for stability during erection.
6. All exposed steel members to be treated and fabricated as architectural steel.
7. Coordinate field visual and non-destructive testing as noted in the contract documents or required by Building Code.
8. Deliveries to be scheduled and sequenced in coordination with the Site Superintendent.
9. Install steel for roof openings, penetrations, supports, etc. located in Pre-Engineered Metal Building Structures
10. Dewater of column blockouts while performing work in this Trade Package.
11. Install all temporary perimeter fall protection/guardrail systems required for erection of this work. Temporary protection shall not be welded to exposed structure. Removal by erector.
12. Receive, offload, stage, inventory, layout, and install all Pre-Engineered Structure, metal decking, metal decking accessories, and misc. steel shall be by the Pre-Engineered Metal Building Erector.
13. Erector shall provide field touchups of shop finish primer and galvanizing at locations where finish is damaged during handling, or erection, including, but not limited to field connection points, bolts, handrails, and hoisting pick points.
14. Clean all steel of dirt, mud, dust, and piece mark identifications prior to completion of erection.
15. Removal of temporary erection aids, welds, run off tabs, and backing strips.
16. Coordination of third party testing.
17. Provide temporary shores, guys, bracing, etc. required for erection.
18. Provide lifts and accommodations for 3rd party testers to access areas to be inspected or tested.
19. All welders to be certified. Trade Contractor will not be responsible for cost of testing and inspections; however, Trade Contractor will be responsible for costs associated with reinspection due to inadequate or unsuitable welds and connections.

20. Provide, install, and demo any concrete required for this trade package. Examples include temporary bracing shores.
21. Provide and install crane pads as required to complete the scope of work in this Trade Package.
22. Trade Contractor will be responsible for any and all means necessary to achieve compliance with OSHA policy. Violation of OSHA policy will result in expulsion of personnel from project.
23. This Trade Package shall include install of interior insulation at Metal Building structures. This shall include any accessories needed for installation of such system.
24. This Trade Package shall not be responsible for glazing/louvers in Pre-engineered structures but shall provide openings with opening framing as directed by Contract Documents and typical details required for such installation.
25. Slab on grade in Expo Hall and Arena shall be installed prior to PEMB erection. Erector shall be required to erect Expo Hall (Area D) from location outside of the building footprint. Scissor lifts shall be acceptable to be placed on the slab on grade. Any lifts or equipment used on finished surfaces such as slab on grade or finished pavement/sidewalks shall be required to use protection to prevent marking. Forms of protection may include temporary floor protection material, socks on tires, non-marking tires, diapers on equipment, or other common forms of protection. Protection shall be provided by the Trade using the equipment and shall be improved as directed by the CM. Trade Contractor shall be required to clean, and replace if necessary, any areas where proper protection was not implemented or where inadequate protection was used.
26. Trade Contractor responsible for erection of PEMB shall have the ability to erect arena framing (Area B/C) from inside of arena floor footprint where not on slab on grade conditions. Trade Contractor shall coordinate access with CM. Trade Contractor shall supply, construct, and deconstruct any temporary crane pads determined to be needed.
27. **Liquidated Damages:** Subcontractor acknowledges and agrees that if it fails to complete the Work on or before the applicable Trade Contract Milestone date, Contractor will sustain damages and loss as a result of such failure and such damages will be assessed to the Contractor by the Owner. Subcontractor agrees to be liable to Contractor for liquidated damages for each calendar day of delay in achieving Trade Contract Milestone date in the amount of two hundred fifty dollars ($250) per day. Contractor and Subcontractor agree that these liquidated damages are reasonable in light of the actual or anticipated damages and harm caused by a delay in achieving Trade Contract Milestone date. Trade Contract Milestone Dates are indicated above in “Schedule”.

Alternates:

28. Alternate 01 shall be for including Stall Barn as indicated on the Construction Documents. Trade Package 05-1b: Pre-Engineered Metal Building Structures Erection: <u>Base Bid Shall not include cost of Stall barn. Alternate 01 price shall be to include erection for Stall Barn with framing, decking, accessories indicated.</u>

Trade Package 5-1c: Pre-Engineered Metal Building Structures Supply & Erection

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Pre-Engineered Metal Building Structures** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 13 3419	Metal Building Systems

Quantity Check: On Section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total tonnage of fabricated steel/connections/stiffeners etc. (tons)
- Lead time to produce shop drawings for Anchor Bolts from date of release (days)
- Lead time to deliver anchor bolts from receipt of approved shop drawings. (days)
- Duration for shop drawings (weeks)
- Duration for fabrication/delivery from approved shop drawings (weeks) Total tonnage of erected steel. (tons)
- Duration for erection (weeks)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Submittals due to CM:
  - Anchor Bolt Shop Drawings: 6 weeks after Notice to Proceed
  - PEMB Shop Drawings (Expo Hall): 6 weeks after Notice to Proceed
  - PEMB Shop Drawings: Remaining buildings: 8 weeks after Notice to Proceed.
  - PEMB Expo Arena – Delivery to Site: 12 weeks from approved shop drawings
  - PEMB Remaining – Delivery to Site : 14 weeks from approved shop drawings
- Milestones:
  - Area D (Expo Hall) PEMB Frame Erection – 20 days
  - Area D (Expo Hall) PEMB Standing Seam Roof, Veneer, and Simple Saver Erection – 20 days
  - Area B/C (Arena) PEMB Frame Erection – 30 days
  - Area B/C (Arena) PEMB Standing Seam Roof, Veneer, and Simple Saver Erection – 25 days
  - Area E (Maintenance) PEMB Frame Erection – 10 days
  - Area E (Maintenance) PEMB Standing Seam Roof, Veneer, and Simple Saver Erection – 10 days
  - Area F (Alt. 1 – Stall Barn) PEMB Frame & Roof Paneling Erection – 20 days

Milestones:

- Durations for Frame Erection activities listed above start at the time that both PEMB Material is delivered to site and slab on grade has reached adequate strength.
- Durations for Standing Seam Roof, Veneer, and Simple Saver Erection activities listed above start at the time that MEP hanger install is complete to receive Simple Saver.
- Milestone for Frame Erection indicates that all primary and secondary framing are installed and have passed third party inspections. Structure shall be required to be plumb, self supporting, permanent bracing installed, safe for other trades to occupy, and ready for succeeding work.
- Milestone for Standing Seam Roof, Veneer, and Simple Saver Erection indicates that structure is complete. Structure is watertight at wall sections except at locations for openings to be filled by other trades such as door, window, or MEP trades. Simple Saver system shall be installed and ready for MEP overhead hanger and piping to occur.

Note: Trade Contractor is not scheduled to erect primary and secondary PEMB Framing at the same time in two different structures. However, failure to meet durations above may require Trade Contractor to require multiple Frame erection crews in multiple structures. Trade Contractor will be required to be erecting primary and secondary framing in one area while installing metal panel roof, veneer, or simple saver insulation in the other area. Trade Contractor shall allow for MEP hanger install on PEMB structure prior to install of simple saver system. Trade Contractor shall coordinate this hanger install time with CM and other Trade Contractors.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. All items listed in Trade Package 5-1a.
3. All items listed in Trade Package 5-1b.

Alternates:

4. Alternate 01 shall be for including Stall Barn as indicated on the Construction Documents. Trade Package 05-1c: Pre-Engineered Metal Building Structures Supply & Erection: Base Bid Shall not include cost of Stall Barn. Alternate 01 price shall be to include Stall Barn with framing, decking, accessories indicated.

Alternates:

5. Alternate 02 shall be for including Stall Barn as indicated on the Construction Documents with galvanized framing.
    a. Trade Package 05-1c: Pre-Engineered Metal Building Structures Supply & Erection: Base Bid Shall not include cost of Stall Barn. Alternate 02 price shall be to include Stall Barn with framing, decking, accessories indicated. Alternate 02 Stall Barn shall be with all framing galvanized as indicated by specifications.
6. Alternate 03 shall be for including galvanized secondary framing for Pre-Engineered Metal Buildings except for maintenance building and Alternate 01/02 Stall Barn.

a. Trade Package 05-1c: Pre-Engineered Metal Building Structures Supply & Erection: Base Bid Price shall be for primed Pre-Engineered Metal Buildings. Alternate 03 shall be for galvanizing all secondary metal building framing.

7. Alternate 04 shall be for including galvanized Primary and secondary framing for Pre-Engineered Metal Buildings except for maintenance building and Alternate 01/02 Stall Barn.
    a. Trade Package 05-1c: Pre-Engineered Metal Building Structures Supply & Erection: Base Bid Price shall be for primed Pre-Engineered Metal Buildings. Alternate 04 shall be for galvanizing all Primary and Secondary metal building framing.

Bid Package 02

Trade Package 2-2: Site Utilities
Trade Package 2-3: Fences and Gates
Trade Package 2-4: Paving & Site Concrete
Trade Package 2-5: Concrete Pavers
Trade Package 2-6: Landscaping & Irrigation
Trade Package 2-7: Equine Protective Surface System
Trade Package 3-1: Structural Concrete
Trade Package 3-2: Polished Concrete Floors & Sealer
Trade Package 4-1: Masonry
Trade Package 5-1a: Structural Steel Fabrication
Trade Package 5-1b: Structural Steel Erection
Trade Package 5-1c: Structural Steel Supply and Erection
Trade Package 6-1: Millwork
Trade Package 7-1 Waterproofing
Trade Package 7-2: TPO Roofing
Trade Package 7-3 EIFS
Trade Package 8-1: Glass & Glazing
Trade Package 8-2: Doors, Frames, & Hardware
Trade Package 8-3: Coiling and Sectional Doors
Trade Package 9-1 Cold Form Framing & Drywall
Trade Package 9-2: Tape, Bed, Paint
Trade Package 9-3: Flooring & Tile
Trade Package 9-4: Resinous Flooring
Trade Package 10-1: Specialties Supply
Trade Package 10-2: Misc. & Install
Trade Package 10-3: Graphics & Signage
Trade Package 10-4 Prefabricated Metal Canopies
Trade Package 15-1: Fire Suppression
Trade Package 15-2: Mechanical
Trade Package 15-3: Plumbing
Trade Package 16-1: Electrical & Fire Alarm

Trade Package 2-2: Site Utilities

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Utilities** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Section 00 3100	Geotechnical Report
Section 32 40 10	Water Distribution
Section 32 40 20	Sanitary Sewerage
Section 32 40 30	Storm Drainage

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total LF of Storm Drain Piping
- Lead Time from approval for Sewer Collection Tanks (Days)
- Duration for installation of Sewer Collection Tanks (Days)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Sewer collection tank product data shall be submitted within 2 weeks of Notice to proceed.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install all underground site utility systems as specified including underground water lines (domestic water, storm sewer, sanitary sewer, fire lines), fire hydrants, thrust blocks, meters, tracer wires, backflow preventers, culverts, headwalls, meter vaults, and sewer collection tanks along with subsequent equipment.
3. Storm Sewer Line 2 (110.0 LF 18" Class IC RCP) shall not be included in this trade package as is was installed through Trade Package 2-1 Alternate.
4. Fire line to be installed to riser room and stubbed up 2'-5'. Backflow preventers to be provided and installed by the Utilities Trade Contractor. Final coordination of fire line elevation and location to be coordinated with sprinkler contractor and CM.
5. Conduits for communications (Cox, AT&T, etc.) to be a portion of the Electrical Trade Package.

6. Final connections (at the building) for domestic water, storm sewer, roof drains, and sanitary sewer to be performed by the Plumbing contractor. Utility contractor to provide lines installed to a point within 5' of where line would enter building with fitting installed and ready for plumber to make final connection. At these locations the Trade Contractor shall provide temporary riser to 3' above grade for final removal and connection by the plumbing Trade Contractor.
7. This Trade Contractor shall be responsible for connecting underslab drainage piping more than 5' from the building. Plumbing Trade Contractor shall be responsible for underslab drainage piping within 5' of exterior of building and under building. At these locations the Trade Contractor shall provide temporary riser to 3' above grade for final removal and connection by the plumbing Trade Contractor.
8. Demolition of existing utilities is included in this trade package where existing utilities interferes. Example would include existing, abandoned oil and natural gas service lines.
9. Provide final connections of all site utilities at tie ins.
10. Include any tap fees, permit fees, and meter fees. Impact fees to be paid by CM.
11. Provide all equipment for the work in this trade package.
12. Carefully review geotechnical report for identified subsurface soil conditions. Trade Contractor shall be responsible for shoring, trench boxes, etc that may be required for installation of utilities.
13. Include meters as well as concrete vaults and all other meter enclosures.
14. Provide all earthwork necessary for utility installation. This includes haul off of spoils as well as meeting compaction requirements set forth in the Contract Documents and geotechnical report.
15. Restore areas where ties ins are made to existing utilities (provide all demolition, cutting, patch, and sod work necessary).
16. Final grading and compacting trenches to within +/- 1 ¼ (.10) of the specified elevations. This +/- requirement shall be balanced to zero. Provide positive drainage away from building pads. Notify site superintendent if this is not possible. This trade package to include repair of any settlement in the utility trenches.
17. Provide tracer wire on all utility piping, whether included in the specifications or not.
18. Coordination of required testing per the Contract Documents and the geotechnical report as it pertains to this Trade Package. Payment for the testing fees will be by others, however, cost for any rework due to failed test remains the responsibility of the earthwork contractor.
19. Update on site as-built set, kept in CM's jobsite trailer, daily with dimensions and elevations of installed utilities.
20. Include protection at open trenches per OSHA standards.
21. Include generators if electricity is required for work in this package.
22. Include temporary dewatering for work included in this trade package.
23. Provide traffic control required for work associated with this trade.
24. Utility Trade Contractor shall be responsible for all costs associated with lane closures as well as traffic control necessary for utility tie ins.
25. Rip rap at storm drain shall be provided and installed by the earthwork Trade Contractor.

26. Provide trench plating and barricading as necessary to maintain safe access for residents and commuters on public streets.
27. Stormlines and headwalls at detention pond to be by this Trade Contractor.
28. This Trade Contractor shall be responsible for coordinating construction around existing pipelines. Trade Contractor shall be familiar with and responsible for published restrictions outlined in plans for work in these areas.
29. This Trade Contractor shall be required to bore under roadways and existing pipelines rather than trench. Trade Contractor shall verify accessibility prior to bidding.
30. This Trade Contractor shall be responsible for coordinating the relocation of the existing communication lines at the south entrance.
31. This Trade Contractor is responsible for the detention pond spillway and outflow structure.

Trade Package 2-3: Fences and Gates

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the Fences and Gates including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 32 31 13	Chain Link Fences and Gates
Division 32 31 19	Decorative Metal Fences and Gates

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total LF of Chain Link Fence
- Total LF of Decorative Metal Fence & Supplier/Manufacturer
- Duration for total installation (Days)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Product data and typical details shall be submitted within 2 weeks of Notice to proceed in order to coordinate with other trades.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Trade Contractor shall be responsible for all install of gate and fence system.
3. Trade Contractor shall provide all layout work required.
4. Trade Contractor shall be responsible for providing foundation embeds, anchors, etc required for gate attachment to foundations where required.
5. Trade Contractor shall be responsible for Knox Padlocks at gates.
6. Track and attachment at sliding gate shall be by this trade contractor.
7. Trade Contractor shall provide all accessories required for complete installation.

Trade Package 2-4: Paving & Site Concrete

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Utilities** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Section 00 31 00	Geotechnical Report
Section 32 50 10	Hot Mix Asphalt Pavement
Section 32 50 15	Cement Concrete Paving
Section 32 50 20	Pavement Joint Sealants

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total SF of asphalt
- Total SF of Concrete Sidewalk
- Total LF of Concrete Curb

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- In order to facilitate construction traffic the curbs and the base course of asphalt at project main drives will be installed early in the project under a first mobilization.
- Top course to be installed under an additional mobilization at end of project.
- Sidewalks to be installed under separate mobilization following completion of exterior veneer.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. At time of tie in at locations where new pavement meets the city streets mill and patch streets as required to ensure existing to remain is free of damage.
3. The Paving & Site Concrete Trade Contractor shall be responsible for all site paving, sidewalks, and curbs.
4. Earthwork Trade Contractor will be responsible for providing grading to +/- 1 ¼ (.10). Paving & Sidewalks Trade Contractor shall be responsible for fine grading.

5. This bid package shall include the parking lot striping including any incidental marking of concrete curbs.
6. This bid package shall be responsible for protection of adjacent surfaces from splatter of asphalt or concrete.
7. Provide detectable warnings where required by drawings or codes at sidewalks.
8. Provide parking stops where indicated on the plans.
9. This Trade Package is not responsible for any gravel pavement, filter fabric, Tensar Triax Geogrid, separation fabric, stabilization, or underlayment beneath gravel paving as a part of the base bid. Gravel Paving to be provided by the owner. Gravel, filter fabric, stabilization, etc beneath asphalt or concrete paving to be by this Trade Package.
10. Provide layout and final grade checks/acceptance prior to commencing work for a given area.
11. This bid package will be responsible for all parking, traffic related signage, and any convenience signage required by code, plans, and specs.
12. Provide curing compound as required by specifications, but not limited to general construction practice.
13. This bid package shall be responsible for supplying and installing all pipe bollards.
14. This bid package will be responsible for caulking at all expansion joints within and at perimeters of installation. This will include where concrete meets the building or vertical surfaces.
15. Supply and install all reinforcing required for the work described in this Trade Package.
16. Paving & Site Concrete Trade Contractor shall be responsible for ensuring that site paving, sidewalks, and ramps meet ADA requirements as well as city requirements regardless of what is shown on the plans. Ramps shall be installed per City of El Reno standards. Trade Contractor to notify Construction Manager to coordinate any areas determined to be out of tolerances prior to pouring/placing.
17. If lane closures or traffic control are required for paving work the Paving & Site Concrete Trade Contractor will be responsible for drafting, submitting, paying for, and pulling the lane closure permit. In addition the setup, breakdown, traffic control equipment, flaggers, etc are all included with the Asphalt & Site Paving bid package.
18. Disposal of concrete from washout area.
19. This bid package includes all layout required to complete included work.
20. This Trade Package responsible for lime stabilization under pavement or concrete sidewalk/paving.
21. Earthwork Trade Contractor to backfill against curbs and pavement.
22. This Trade Contractor shall not include Polylast flooring as called off in documents but should provide adequate blockout for such system where applied over concrete/asphalt paving by this Trade Package.

Alternates:

23. Base Bid shall not include “Gravel with Tensar Triax Geogrid” as shown on 2/C1-3 and C2-0. Alternate 01 shall include add alternate price to base bid to include this at areas indicated. Add Alternate 01 price shall be for 6” compacted gravel over Tensar Triax Geogrid over 8” modified subgrade and shall include improving subgrade, geogrid, gravel, and all material and labor to form the complete roadway section indicated in drawings.
24. Base Bid shall not include area indicated as “Gravel” as shown on 2/C1-3 and C2-0. Alternate 02 shall include add alternate price to base bid to include this at areas indicated. Add Alternate 02 price shall be for 6” compacted gravel 8” modified subgrade and shall include improving subgrade, providing material, and gravel placement to form the complete roadway section indicated in drawings.

25. Base Bid shall not include asphalt paving noted in S2-1F for Stall Barn. Alternate 03 shall be to include Asphalt paving with required subbase requirements to the extents shown for the Stall Barn.
26. Base Bid: Trade contractor shall be responsible for Paving 2 noted on A2-1A for concrete paving between vehicle grade pavers. Concrete paving 2 shall go in place prior to pavers and shall maintain dimension constraints for the pavers. Alternate 04 shall be deduct pricing to remove this area from this Trade Package scope of work.

Trade Package 2-5: Concrete Pavers

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the Concrete Paving including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 32 14 00	Unit Paving

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total SF of Pavers
- Paver type and lead time
- Duration for total installation (Days)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Product data and typical details shall be submitted within 2 weeks of Notice to proceed in order to coordinate with other trades.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Trade Contractor shall be responsible for all install of paver system including any trim/transition pieces required, curbs and edge restraint, joint filler, and setting bed materials to provide a complete system.
3. Trade Contractor shall provide all layout work required.
4. Trade Contractor shall be responsible for cutting and cleanup of material.
5. Trade Contractor shall refer to A2-1A for notes on fit, layout, and performance.
6. Trade Contractor shall be responsible for compacted drainage aggregate base, geotextile fabric, bedding layer, and paver curb under adhered edge paver as shown in detail 2/A8-2.
7. Trade Contractor shall be responsible for compacting aggregate base and bedding layer per requirements of the specifications, documents, and manufactures requirements.

Trade Package 2-6: Landscaping & Irrigation

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Landscaping & Irrigation** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 32 92 00	Turf and Grasses
Division 32 93 00	Plants

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total Weeks of Install (Plants, Trees, Irrigation, hardscape)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- **Trade Contractor shall include a mobilization(s) in Fall of 2020 in order to seed/sod disturbed grading areas. At CM's direction prior to final landscaping, selected areas will be seeded/sodded.**

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Trade Contractor shall include all landscaping, trees, plantings, grasses, planting beds, sodding, turf, seeding, irrigation, hardscapes for a complete and operational system as indicated in the Contract Documents.
3. Provide and install irrigation system & associated control wiring per Contract Documents.
4. Irrigation meter will be provided by the Utility Trade Contractor. Landscape Trade Contractor to tie into meter and provide remainder irrigation of system.
5. Backflow preventers for irrigation shall be provided by this Trade Package.
6. Provide and install landscape boulders and decorative stone per the Contract Documents.
7. Provide and install lawns and grasses per the Contract Documents. Include finish grading, raking, rolling, and watering.
8. Sod installed on a slope shall be pinned down.

9. Provide and install seeding per the Contract Documents.
10. Provide temporary irrigation and lawn maintenance per the Contract Documents.
11. Furnish and install all underground irrigation piping, sleeves, backflow preventers, controllers, rain/freeze sensors, drip control kits, vacuum breakers, valves, flush valves, gravel, pressure regulator, basket filters, control valves, soil staples, fittings, low voltage wiring, controller, environmental sensors, marking tapes, trenching, backfilling, and miscellaneous required for complete, operational, and finished systems.
12. Provide and install exterior plants as indicated in the Contract Documents. Furnish and install all trees, T-posts & tie wire, camb guards, straps, mulch, mycor tree saver, backfilling, and edging as noted in the Contract Documents.
13. Topsoil
    a. Earthwork Trade Contractor will provide topsoil at sodded areas to within +/- 1 ¼" (.10).
    b. Landscaping Trade Contractor shall provide final grade of sodded areas.
    c. Landscaping Trade Contractor shall provide and install topsoil at areas with trees, plants, and shrubs per the Contract Documents.
    d. Landscape Trade Contractor shall provide topsoil at beds and planters per the Contract Documents.
14. Provide and maintain temporary Irrigation until landscaping, seeding, and sod is established per Contract Documents and Specifications.
15. Provide all planting accessories necessary for a complete installation of the items within this trade package and as indicated in the Contract Documents.
16. Provide sleeves for irrigation lines crossing under hard surfaces.
17. Provide pex-A supply piping to the backflow preventer. PVC may be used after backflow preventer.
18. Provide and install concrete foundation(s) for irrigation RPZ.
19. All structure beyond what is shown in the Contract Documents necessary for a complete installation shall be included by this Trade Contractor.
20. Remove masking and protective films from equipment and dispose of at dumpster.
21. Hydroseeding shall be per the specifications. Only approved product with Bonded Fiber Matrix will be allowed. Landscape subcontractor shall be responsible for patching areas where first application was insufficient, thin, and/or did not seed. Hydroseeding shall be applied at rates that match manufacturers recommendations for slope/grading/soil type indicated on the drawings and at a minimum rate as required by the specifications.
22. After application of hydroseeding/sod, any rutting or washouts that occur shall be repaired by the landscaping subcontractor.
23. Unit Pavers are not considered part of this base bid scope of work.
24. Trade Contractor shall include fabric wrap, aggregate base, and planting mix for planters as shown in detail 2/A8-2.
25. Alternate: Provide Add alternate 01 for this trade package to be responsible for all elements noted on A2-1A for concrete paving, pavers, concrete planters, subbase, and woodwork in addition to landscape and irrigation requirements already in this Trade Package Scope of Work. Concrete paving 2 shall go

in place prior to pavers and shall maintain dimension constraints for the pavers. Alternate 01 shall be to include this complete scope of work as a part of this trade package.

Trade Package 2-7: Equine Protective Surface System

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the Equine Protective Surface System including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 32 18 16	Equine Protective Surface System

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section.

- Total SF of Equine Protective Surface System
- Lead Time from approval for Installation
- Duration for total installation (Days)

These quantities are for reference only. Trade contractor is responsible for actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Product data and typical details shall be submitted within 2 weeks of Notice to proceed in order to coordinate with other trades.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Trade Contractor shall be responsible for all install of surface system including any trim/transition pieces required.
3. Trade Contractor shall be responsible for cleaning substrates prior to install of surface system.
4. Trade Contractor shall be responsible for any moisture/adhesion testing required for install.
5. Trade Contractor shall be responsible for providing protective covering over finished product such as Ram Board or other approved product.

Trade Package 3-1: Structural Concrete

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification 03 30 00	Cast-in-Place Concrete
Specification 03 35 43	Polished Concrete Finishing
Specification 07 26 00	Vapor Retarders
Specification 07 19 00	Water Repellents

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- [CY of concrete]
- [SF of slab]
- Tons of rebar
- SF of Concrete slab on grade to be polished by others

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

The following is a highlight of the key items but not a complete list, refer to plans and specifications:

1. All items listed in the Standard Bid Instructions for All Bidders.
2. General Structural Concrete Items
    a. Provide turnkey concrete scope of work as shown in the Contract Documents or as typically performed by this Trade Package. This includes providing all labor, material and equipment necessary for a complete concrete installation.
    b. Provide all layout of the work within this Trade Package.
    c. Concrete materials and methods are required to be per the ACI Manual of Concrete Practice, unless noted otherwise in the Contract Documents. Some examples of requirements covered in the Manual of Concrete Practice are concrete mixture proportioning, mixing, transporting, concrete placing, hot and cold weather concreting, formwork, and construction tolerances.
    d. If lane closures or traffic control are required for concrete work provide all drafting, submitting, paying for, and pulling the lane closure permit. In addition; the setup, breakdown, traffic control equipment, flaggers, etc. shall be included.
    e. This Trade Contractor shall be responsible for creating, maintaining, using and disposing of the concrete washout area in coordination with SWPPP drawings and guidelines.

f. Protect adjacent surfaces from splatter of concrete. This Trade Contractor shall be responsible for costs associated with cleaning splatter that occurs as a result of improper protection.
g. Provide all concrete accessories required for this scope of work.
h. Provide and install perimeter insulation board adjacent to footings.
i. Supply, install and maintain OSHA approved reinforcing protection caps where necessary for the concrete within this bid package. Caps shall remain in place until no longer necessary.
j. Shop drawings shall consist of detailed drawings showing all bends, lengths, sizes, splices, development lengths, mechanical accessories, etc. Plans, elevations, and sections shall be shown for footings, walls, and elevated beams.
k. To the greatest extent possible all bending, cutting, and fabrication shall be performed in the shop by a reinforcing fabricator unless approved otherwise by Lingo Construction.
l. This Trade Package shall be responsible for layout and installation of all embeds and anchor bolts (provided by others). Clean anchor bolts of any concrete and/or dirt and leave them such that they are ready for nuts to be threaded by steel erector. Damaged anchor bolts shall be replaced or substituted by this Trade Packaged.
m. Provide final survey of installed anchor bolts as well as any baseplate adjustments for bolts that are slightly off the mark. Notify Lingo Construction within 7 days of placing anchor bolts, if any anchor bolts are not located correctly.
n. Costs associated with modification to steel structural framing due to misplaced anchor bolts shall be by this Trade Contractor for incorrectly located anchor bolts that are not corrected.
o. Include haul off of all spoils created as a result of work associated with this Trade Contract.
p. Foundations
    i. This Trade Contractor will have final responsibility of accepting the pad after grading is complete.
    ii. After the building pad is accepted this Trade Contractor will be responsible for excavating all footings & thickened slab edges and hauling spoils offsite. Backfill to grade at foundations is also the responsibility of this Trade Contractor.
    iii. This Trade Package shall be responsible for reinforcing dowels from footings to the masonry walls but not for reinforcement in the masonry walls.
q. Slabs
    i. This Trade Contractor to submit expansion/control joint layout plan four weeks prior to pouring any slabs. Layout Plan shall be submitted to AOR/EOR for approval and comment. Control joints are to be saw-cut the same day as concrete placement.
    ii. Provide the underslab termite treatment and warranty.
    iii. Provide gravel and vapor barrier underlayment for slab on grade. Install vapor barrier per manufacturer's recommendations.
    iv. If building slab is placed in low light conditions this Trade Package shall be responsible for providing light towers to ensure workers have enough light to provide a quality finish on the slab.
r. Provide all concrete accessories required for this scope of work.
s. Concrete blockouts for structural steel columns, precast columns, mechanical piping, or other items deemed necessary shall be installed by this Trade Package. In addition, this Trade Package shall be responsible for filling concrete blockouts after steel columns, or other items are installed (this may require a separate mobilization).
t. This Trade Package shall be responsible for grouting all baseplates.
u. Provide and install all mechanical equipment pads and curbs inside the building.

v. This trade package shall not be responsible for the polishing of concrete slab on grade but shall be responsible for the placing of the concrete slab on grade.
w. This trade package is responsible for gate foundations, ramps, stairs, dumpster slabs, transformer pads, and lightpole bases.
x. This Trade Contractor shall be responsible for blockouts for items such as, but not limited to, walkoff mats, expansion joint covers, walk in cooler/freezers, or other items shown but not specifically detailed on the contract documents.
y. Trade Contractor shall adhere to FF/FL requirements detailed in the specifications for slabs.
z. Trade Contractor shall cure slabs as required by specifications for polished areas.
aa. This Trade Package shall be responsible for site wall, gate, bollard foundations. Refer A8-2, A8-2-1 for example.
bb. This Trade Package shall be responsible for concrete cast-in-place planters shown on A2-1A and in details shown on A8-2. Trade Contractor shall be responsible for foundation for planters, formwork, placement, and smooth rub finish as specified in details. Refer Specifications for formwork requirements for concrete exposed to public view.
cc. Slab on grade in expo and arena shall not be placed before CMU wall and PEMB framing. Refer S5-2 for pedestal foundation at Expo. Grade beams, tie beams, and pedestal shall be placed and PEMB erected before slab on grade is placed. This shall be typical at other locations such as Arena.
dd. This Trade package shall be responsible for concrete-cast trench drains when trench drains are not premanufactured.

Alternates:

ee. This Trade Package shall include Stall Barn foundations, tie beams, etc as part of Alternate #01. Base bid shall not include elements required for Stall Barn.
ff. This Trade Package shall include deduct alternate to not include planters as shown on A2-1A as a part of Alternate #02.

Trade Package 3-2: Polished Concrete Floors & Sealer

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Polished Concrete Floors & Sealer** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 03 35 43	Polished Concrete Floor Finish
Division 07 92 00	Joint Sealants

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- SF of polished concrete

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Submit product data within two weeks of notice to proceed.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Polished Concrete Trade Contractor to polish concrete floors per plans and specifications.
3. At time of work electricity will not yet be available. Therefore, Polished Concrete Trade Contractor to source and provide generator.
4. Polished Concrete Trade Contractor shall also be responsible for staining and sealing of all interior and exterior concrete as indicated on the Contract Documents.
5. After polishing and staining of interior slabs provide and install Surface Shields Builder Board with Liquid Shield floor protection along with Surface Shields Builder Board Tape on full surfaces.
6. Provide 1/8" hardboard as required by specification for all corridors/heavy traffic areas with polished or sealed concrete. This shall be as a minimum all of Corridors in office area (1.03.02) and 48" min. width walkway across Arena east and south wall and Expo hall west wall.

Trade Package 4-1: Masonry

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Masonry** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Division 04 20 00	Unit Masonry
Division 04 21 13	Brick Masonry
Division 04 72 00	Cast Stone Masonry

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- SF of face brick
- SF of block
- Lead Time for materials

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

- Trade Contractor shall submit Product Data, Product samples, and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.
- Structural lintels shall be installed prior to masonry mobilization to accommodate weather barrier installation. Masonry Contractor shall provide adequate time for waterproofing Trade Contractor to waterproof and flash loose laid lintels.
- Masonry Contractor shall coordinate a minimum 24 hours in advance for waterproofing trade contractor to provide waterproofing required at loose lintels.
- Where sequencing/schedule references two areas at one time, the contractor shall provide equipment and crew of sufficient size to complete work concurrently in each area.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.

2. Masonry Trade Contractor shall include CMU, brick, mortar, grout, mortar net, weep vents, all reinforcement, masonry anchors, masonry flashings, and masonry accessories.
3. Exterior Masonry Veneer: refer to Contract Documents
4. Interior Masonry Veneer: Colored Split Face CMU as indicated in plans
5. Interior Masonry Veneer: Refer A9-3-1 (SP2) – Brick Interior Veneer
6. Brick Selection: refer to Contract Documents
7. Furnish and install all through wall flashing within perimeter of masonry walls.
8. The Masonry Trade Contractor shall be responsible for supplying and installing all reinforcing and dowels required in CMU walls. Concrete Trade Contractor to provide and install dowels from foundation to base of CMU walls only if they are noted to be cast in place and not installed after concrete work is complete.
9. Door jambs within CMU block shall be provided by the Construction Manager and installed by the Masonry Trade Contractor.
10. Grout filling of all hollow metal frames shall be the responsibility of the Masonry Trade Contractor. Supply and install foam blocking for hardware in grouted hollow metal frames.
11. Waterproofing & Flashing Coordination:
    a. The Roofing Trade Contractor will be responsible for installing the roofing membrane underneath the parapet caps.
    b. The weather barrier installer shall be responsible for flashing and sealing penetrations through walls. Examples of penetrations are j-boxes, hose bibs, security camera boxes, vents, etc.
    c. The Masonry Trade Contractor is responsible for installing brick ties in a way that is acceptable by the approved weather barrier manufacturer as well as supplying and installing the material necessary for sealing the fastener penetrations.
    d. The Masonry Trade Contractor shall be responsible for providing through wall flashing where necessary at the masonry walls. This shall include the base of the wall, under brick rowlocks, at the top of openings such as windows & doors.
    e. The Masonry Trade Contractor shall be responsible for placing end dams along vertical transitions where masonry abuts other materials.
    f. The Roofing Trade Contractor shall be responsible for all flashing touching the roof system, including the parapet caps. Parapet caps to be designed in such a way that sections can be removed individually, without taking off adjacent sections.
    g. Mechanical, Plumbing, and Electrical Trade Contractors shall be responsible for providing and installing pipe portals for all rooftop penetrations associated with their work. The roofing Trade Contractor shall be responsible for the roofing membrane and flashing of pipe portals.
    h. The Waterproofing Trade Contractor shall be responsible for the sealant associated with expansion joints located within masonry.
    i. The Waterproofing Trade Contractor shall be responsible for insulating/caulking required around penetrations, hollow metal doors, and perimeter openings.
    j. Glass & Glazing Trade Contractor to furnish and install all flashings and sealants at the perimeter and within their glazing systems.
    k. The Roofing Trade Contractor shall provide and install all material associated with rooftop expansion joints.

12. All masonry trash, debris, concrete, grout etc. or other materials produced by this Trade Contractor are to be removed from the site by this Trade Contractor.
13. Fasteners associated with masonry ties shall be installed prior to rigid insulation. Provide and install masonry ties designed to accommodate this.
14. Install loose lintels.
15. All accessories for a complete system are included with this Trade Package: horizontal reinforcing, brick ties, base flashing, sill flashing, through wall flashing, weeps, control joints, cavity vents, cavity mortar control, non-shrink grout at base cavity, etc.
16. All concrete reinforcing that goes in unit masonry work is included in this bid package including drilling and epoxy dowels into slab/footings.
17. Masonry Trade Contractor to install all loose brick lintels and relief angles provided by Construction Manager.
18. Trade Contractor shall provide and erect all scaffolding and hoisting related to the Masonry work. Receive, unload and provide storage of items, furnished by others and installed by this Bidder. Daily inspections and sign offs for OSHA compliance will be provided by this subcontractor for the scaffolding associated with masonry work.
19. Weather protection including all cold, hot and inclement weather protection to maintain the project schedule including the proper masonry additives and protection.
20. Clean up and wash down of work.
21. Masonry Trade Contractor to provide and install interior block walls.
22. Mock ups, shop drawings, submittals, product data, maintenance data, certifications, samples, warranties per specifications as required for approval.
23. Protection of in-place items and finished surfaces.
24. Repair incidental damage, due to masonry installation, to the damproofing. Examples would be missing a stud when installing a masonry tie and filling void with NP1.
25. Trade Contractor shall be responsible for re-testing fees due to failure/performance issues of Construction Manager provided special inspections.
26. Brick should be cleaned before scaffold is relocated and/or within 3 days of installing.
27. Exterior Facade Mockup
    a. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
    b. Approximate mockup size is 10’ tall by 12’ wide and will incorporate parapet and corner.
    c. Final design of mockup to be determined.
28. Provide and install masonry at dumpster enclosure and entry signage.
29. Trade Contractor shall supply cast stone caps and banding where noted.
30. This trade Contractor shall not be responsible for interlocked block waste bunkers.

Alternates:

31. This Trade Package shall include Stall Barn Masonry Scope as part of Alternate #01. Base bid shall not include elements required for Stall Barn.

Trade Package 5-1a: Structural Steel Fabrication

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 05 12 00	Structural Steel Framing
Specification Section 05 21 00	Steel Joist Framing
Specification Section 05 31 00	Steel Decking
Specification Section 05 50 00	Metal Fabrications

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number of tons
- Lead time for shop drawings to be provided. (Days)
- Steel delivery from receipt of approved shop drawings. (Days)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below.

The following is a highlight of the key items but not a complete list, refer to plans and specifications:

1. General Structural Steel Items
    a. All items listed in General Trade Package.
    b. The structural steel fabricator, this trade package, shall be responsible for providing shop drawings, connection design, fabrication, and delivery of all structural steel related items. This Trade Package no responsible for Pre-Engineered Metal Building Frame. This Trade Package shall provide design, engineering, and licensed professional engineer's seal for all connection calculations that are not shown in the contract documents or that are designated as part of a delegated design. Items typically provided by this trade shall include, but not be limited to the following: structural steel framing; galvanized structural steel framing; steel columns, bracing, beams, fixed and loose lintels, associated fasteners, embeds, anchor bolts, headed studs, steel stair framing, joists and decking, bearing plates, top of CMU wall bracing, miscellaneous steel typically required, and steel framed canopies as shown on the architectural and structural plans.
    c. This trade contractor shall include all items associated with the joist and decking including but not limited to decking, joist, bridging, bridging attachment, collector angles, fasteners, acoustical decking, acoustical decking insulation and accessories, composite decking and

accessories, closure angles. This Trade Package does not include PEMB metal paneling or accessories for PEMB metal paneling attachment.

d. Provide all handrails and guardrails inside the building as well as on site that are primed/painted. Stainless steel handrails are not provided by this trade, although stanchions for posts shall be provided by this trade.
e. Provide mechanical unit, exhaust frame, or other roof penetration support framing as required to support roof decking at openings or under concentrated loading.
f. Provide all fasteners (bolts, nuts, washers, tension control fasteners, anchors, and epoxy adhesives) necessary to complete installation for the items provided in this Trade Package.
g. Provide connections to concrete, masonry, or other non-steel substrates where installation of steel must occur after substrate is already in place. This does not include PEMB to CMU/Concrete connections.
h. Provide shop-made steel templates for each set of anchor bolts.
i. Provide grey primer at all steel that is to receive primer or paint.
j. Hot dip galvanize steel as noted on the Contract Documents shall be provided by this Trade Package.
k. Provide shop visual and non-destructive testing as noted in the contract documents.
l. On the bid form indicate Yes/No AISC Certified per specification. If the answer is no, the Fabricator shall include the cost for the "In Plan Inspections" associated with the special inspection's requirements of the IBC.
m. Steel deliveries to be scheduled and sequenced in coordination with the Site Superintendent and Steel Erector. This trade contractor shall coordinate for delivery arrival the week prior to erection start dates listed in schedule.
n. Provide dumpster gate and enclosure steel framing, bollards, and other miscellaneous steel framing around the site. Exterior steel framing shall be hot-dipped galvanized unless noted otherwise in drawings.
o. Provide camber on framing as indicated by Contract Documents.
p. This Trade Package shall provide embeds for C.I.P. concrete and CMU elements.
q. Provide fabricated and prefabricated items such as ladders as mentioned in structural steel framing specification.
r. Areas to receive spray on fire proofing, or similar material, shall not be primed or painted but shall be prepped for application of approved fire proofing.
s. This trade package shall include ½" diameter minimum cable and attachment brackets for an OSHA compliant guardrail system along elevated deck edges during construction. Material shall be installed and removed by the steel erector.
t. All exposed steel members to be treated and fabricated as architectural steel. This trade contractor shall be responsible for repair of items damaged/scuffed during shipping. Material damaged prior to unloading at site shall be the responsibility of this trade package.
u. Refer detail 2&3/S3-2C. This Trade Contractor to provide horizontal girt shown along with embed and DBA for anchorage to CMU wall.
v. At HSS Framing in exterior wall, provide ¾" diameter hole @ 4'-0" o.c. in tube to infill with spray foam. Spray foam by others. Refer detail 2&3/S3-2C, 5/A8-1, and other similar details for conditions not specifically shown.

Trade Package 5-1b: Structural Steel Erection

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 05 12 00	Structural Steel Framing
Specification Section 05 21 00	Steel Joist Framing
Specification Section 05 31 00	Steel Decking
Specification Section 05 50 00	Metal Fabrications

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Approximate crane size to be provided by erector. (Height & tons)
- Total Tonnage of Steel to be erected (tons)
- Contractor duration for total Trade Package erection (days)
    - Crew Size (men)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

The following is a highlight of the key items but not a complete list, refer to plans and specifications:

1. General Steel Erection Items
    a. All items listed in General Trade Package.
    b. The structural steel erector shall be responsible for installation of the following items: all items provided by the structural steel fabricator, structural steel framing, miscellaneous steel, fixed lintels and associated fasteners, stair, joists and decking along with joist and decking accessories, and bearing plates as shown on the architectural and structural plans. Loose lintels to be installed by the Masonry Trade Contractor. Installation of all field welded edge angles and bent plate slab extensions as well as loose deformed bar anchors. Install steel for roof and floor openings, penetrations, supports, etc. Install all interior handrails and guardrails that weld to stair stringers or slab edges. Stainless handrails and guardrails to be installed by a separate Trade Package. Pre-Engineered Metal Building to be installed by a Separate Trade Package.
    c. Steel Erection Trade Contractor responsible for setting anchor bolt bearing elevations based off of project Benchmarks. Steel Erection Trade Contractor shall be responsible for verifying

anchor bolt and embed layout prior to erection. This Trade Contractor shall be responsible for notifying CM of any discrepancy in layouts prior to erection to avoid delays.

d. Dewater of column blockouts while performing work in this Trade Package.
e. Provide and install all temporary perimeter fall protection/guardrail systems, including but not limited to 2nd floor edge and stairwells. Removal by others. Coordinate system with CM prior to installation.
f. Receive, offload, stage, inventory, layout, and install all structural steel, metal decking, metal decking accessories, stairs, steel joists, and misc. steel associated with this Trade Package.
g. Provide field touchups of shop finish primer and galvanizing at locations where finish is damaged during delivery, handling, or erection, including, but not limited to field connection points, bolts, handrails, and hoisting pick points.
h. Removal of temporary erection aids, welds, run off tabs, and backing strips.
i. Coordination of third party testing. Trade Contractor will not be responsible for cost of testing and inspections; however, Trade Contractor will be responsible for costs associated with reinspection due to inadequate or unsuitable welds and connections.
j. Provide temporary shores, guys, bracing, etc. required for erection. This Trade Contractor to provide all necessary equipment required to complete erection.
k. Provide lifts and accommodations for 3rd party testers to access areas to be inspected or tested.
l. All welders to be certified.
m. Provide, install, and demo any temporary concrete required for this trade package. Examples would include crane pads, tiebacks, and deadman.
n. Provide, install, and remove crane pads as required to complete the scope of work in this Trade Package.
o. Trade Contractor will be responsible for any and all means necessary to achieve compliance with OSHA policy. Violation of OSHA policy will result in expulsion of personnel from project.
p. For their equipment Trade Contractor shall obtain all required permits and clearance.
q. All exposed steel members to be treated as architectural exposed steel. This trade contractor shall be responsible for repair of items damaged/scuffed during handling and erection. This trade contractor shall accept condition of material at time of delivery to site. Material damaged prior to unloading shall be the responsibility of the steel fabricator. Trade Contractor shall document and report any prior conditions prior to unloading. Clean all steel of dirt, mud, dust, and piece mark identifications prior to completion of erection.
r. Trade Contractor shall verify all material prior to installation.

Trade Package 5-1c: Structural Steel Supply and Erection

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 05 12 00	Structural Steel Framing
Specification Section 05 21 00	Steel Joist Framing
Specification Section 05 31 00	Steel Decking
Specification Section 05 50 00	Metal Fabrications

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number of tons
- Lead time for shop drawings to be provided. (Days)
- Steel delivery from receipt of approved shop drawings. (Days)
- Approximate crane size to be provided by erector. (Height & tons)
- Total Tonnage of Steel to be erected (tons)
- Contractor duration for total Trade Package erection (days)
- Crew Size (men)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

The following is a highlight of the key items but not a complete list, refer to plans and specifications:

1. General Steel Supply and Erection Items
    a. All items listed in General Trade Package.
    b. All items listed in Trade Package 05-1a: Structural Steel Supply
    c. All items listed in Trade Package 05-1b: Structural Steel Erection
    d. Trade Contractor shall be responsible for coordination between Trade Packages 05-1a and 05-1b.

Trade Package 6-1: Millwork

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Millwork** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 06 20 23	Interior Finish Carpentry
Specification Section 06 41 16	Plastic-Laminate Face Architectural Cabinets
Specification Section 12 36 61	Simulated Stone Countertops

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Time required to submit shops after NTP (Days)
- Time required to fabricate and procure material upon return of approved shops (Days)
- Time Required to install (Days)
- Total sf of countertop

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install all labor, materials, and equipment required to install all casework, millwork, architectural woodwork, base & upper cabinets, countertops, solid surface countertops, backsplashes, adjustable shelving, hardware and accessories, grommets, cubbies, hanger rods, support panels, solid surface window sills, laminate wall panels, and digital prints on high pressure laminate wall panels for a complete and finished interior architectural woodwork system.
3. Provide and install all laminate clad casework, wall paneling, backsplashes, and countertops.
4. Provide submittals and shop drawings for all millwork and wall paneling.
5. This trade contract responsible for all field verification of dimensions and conditions. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without

field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of casework and millwork for accurate fit.

6. This trade contractor shall provide protection of all stored work and finished work.
7. Provide and install the aluminum corner molding associated with millwork.
8. Provide all glass doors, shelving standards and shelving, locks, and tackable surfaces located within the display cabinets.
9. Provide and install all countertop brackets and associated blocking necessary for countertop supports. Coordinate installation with Interior Framing Trade Contractor if placement of metal studs is critical.
10. Provide caulking of all backsplashes, countertops, cabinets, and work where it abuts walls or other dissimilar materials.
11. Provide all cutouts for sinks, data, and electrical as laid out in the field by other trades and as directed by the Construction Manger.
12. Provide layout and fasten templates for in-wall blocking and backing by others. Exact locations, elevations, sections, details and attachments for the blocking requirements, as required.
13. Prior to closing walls, this trade contractor shall inspecte/verify via site visit of any blocking installed for millwork and notify Construction Manager of any discrepancies prior to walls being closed.
14. Provide and install site fabricated tackable wall systems.
15. Note: per Contract Documents, floor finishes shall extend under millwork.
16. Millwork Trade Contractor shall be responsible for providing and installing floating bracket supports as indicated by detail 16/A8-5. Millwork Trade Contractor shall install brackets in coordination with Framing Trade Contractor. Millwork Trade Contractor shall provide shop drawing indicating layout prior to installation for Framing Trade Contractor to use in wall stud framing layout.
17. Trade Contractor shall provide, install, and finish wood planking as described in drawings. Examples include detail 6&7/A6-3 and 2/A8-6.

Trade Package 7-1 Waterproofing

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Waterproofing** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification 07 27 26	Fluid Applied Membrane Air Barriers
Specification 07 13 26	Self Adhering Sheet Waterproofing
Specification 07 92 00	Joint Sealants
Specification 07 95 00	Expansion Control

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of weather barrier
- Crew Size (#) & Duration (Days)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.

The following is a highlight of the scope of work associated and to be included in this bid package:

a. All items listed in General Trade Package.
b. Provide and install all products per the manufacturer's recommendations.
c. Regardless if shown on the Contract Documents provide all accessories required or recommended by manufacturer for a warrantable and leak free installation.
d. Provide and install vertical expansion joint covers located within building facades.
e. Waterproofing & Flashing Coordination:

i. The Roofing Trade Contractor will be responsible for installing the roofing membrane underneath the parapet caps.
ii. The weather barrier installer shall be responsible for flashing and sealing penetrations through walls. Examples of penetrations are j-boxes, hose bibs, security camera boxes, vents, etc.
iii. The Masonry Trade Contractor is responsible for installing brick ties in a way that is acceptable by the approved weather barrier manufacturer as well as supplying and installing the material necessary for sealing the fastener penetrations.
iv. The Masonry Trade Contractor shall be responsible for providing through wall flashing where necessary at the masonry walls. This shall include the base of the wall, under brick rowlocks, at the top of openings such as windows & doors.
v. The Masonry Trade Contractor shall be responsible for placing end dams along vertical transitions where masonry abuts other materials.
vi. The Roofing Trade Contractor shall be responsible for all flashing touching the roof system, including the parapet caps. Parapet caps to be designed in such a way that sections can be removed individually, without taking off adjacent sections.
vii. Mechanical, Plumbing, and Electrical Trade Contractors shall be responsible for providing and installing pipe portals for all rooftop penetrations associated with their work. The roofing Trade Contractor shall be responsible for the roofing membrane and flashing of pipe portals.
viii. The Waterproofing Trade Contractor shall be responsible for the sealant associated with expansion joints located within masonry.
ix. The Waterproofing Trade Contractor shall be responsible for insulating/caulking required around penetrations, hollow metal doors, and perimeter openings.
x. Glass & Glazing Trade Contractor to furnish and install all flashings and sealants at the perimeter and within their glazing systems.
xi. The Roofing Trade Contractor shall provide and install all material associated with rooftop expansion joints.

f. Exterior Facade Mockup
i. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
ii. Approximate mockup size is 10’ tall by 12’ wide and will incorporate parapet and corner.
iii. Final design of mockup to be determined.

g. Provide and install all exterior weather barrier.
h. Weather Barrier (Spec: 07 27 26) shall be applied by weather barrier trade contractor.
i. Provide all necessary lifts and scaffolding to complete this scope of work.
j. Exterior Facade Mockup
a. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
k. Approximate mockup size is 10’ tall by 12’ wide and will incorporate parapet and corner.
l. Final design of mockup to be determined.

Trade Package 7-2: TPO Roofing

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **TPO Roofing** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 06 6100	Rough Carpentry
Specification Section 07 5419	Polyvinyl-Chloride (PVC) Roofing
Specification Section 07 5423	Thermoplastic Polyolefin Membrane Roofing
Specification Section 07 6200	Sheet Metal Flashing and Trim
Specification Section 07 7200	Roof Accessories
Specification Section 10 7313	Awnings

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of roofing membrane

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Trade Contractor must hold and maintain a State of Oklahoma Roofing Contractor's License. Submit copy of license with the bid packet.
3. Roofing Trade Contractor must be an approved installer by the roof membrane manufacturer. Submit approval letter along with the bid packet.
4. Provide and install TPO roofing, roof insulation, and associated protection board per the Contract Documents.

5. Provide all sheet metal flashing, counterflashing, roof coping, closures, accessories, clips, fasteners, gaskets and sealants related to the roofing work.
6. Provide and install expansion joint systems located within the roof system.
7. Provide and install metal flashings associated with the roof expansion joints. In addition, provide sealants associated with metal flashings.
8. Provide and install gutters, downspouts, and associated precast concrete splash pads.
9. Detailing around all penetrations by other trades.
10. Provide and install all products per the manufacturer's recommendations.
11. Regardless if shown on the Contract Documents provide all accessories required or recommended by manufacturer for a warrantable and leak free installation.
12. Waterproofing & Flashing Coordination:
    a. The Roofing Trade Contractor will be responsible for installing the roofing membrane underneath the parapet caps.
    b. The weather barrier installer shall be responsible for flashing and sealing penetrations through walls. Examples of penetrations are j-boxes, hose bibs, security camera boxes, vents, etc.
    c. The Masonry Trade Contractor is responsible for installing brick ties in a way that is acceptable by the approved weather barrier manufacturer as well as supplying and installing the material necessary for sealing the fastener penetrations.
    d. The Masonry Trade Contractor shall be responsible for providing through wall flashing where necessary at the masonry walls. This shall include the base of the wall, under brick rowlocks, at the top of openings such as windows & doors.
    e. The Masonry Trade Contractor shall be responsible for placing end dams along vertical transitions where masonry abuts other materials.
    f. The Roofing Trade Contractor shall be responsible for all flashing touching the roof system, including the parapet caps. Parapet caps to be designed in such a way that sections can be removed individually, without taking off adjacent sections.
    g. Mechanical, Plumbing, and Electrical Trade Contractors shall be responsible for providing and installing pipe portals for all rooftop penetrations associated with their work. The roofing Trade Contractor shall be responsible for the roofing membrane and flashing of pipe portals.
    h. The Waterproofing Trade Contractor shall be responsible for the sealant associated with expansion joints located within masonry.
    i. The Waterproofing Trade Contractor shall be responsible for insulating/caulking required around penetrations, hollow metal doors, and perimeter openings.
    j. Glass & Glazing Trade Contractor to furnish and install all flashings and sealants at the perimeter and within their glazing systems.
    k. The Roofing Trade Contractor shall provide and install all material associated with rooftop expansion joints.
13. Exterior Facade Mockup
    a. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
    b. Approximate mockup size is 10' tall by 12' wide and will incorporate parapet and corner.
    c. Final design of mockup to be determined.

14. Provide manufacturer's system warranty per the Contract Documents warranty to start at date of substantial completion for the building and not from install date.
15. Provide and install walking pads as indicated on the Contract Documents. Regardless of what is shown on the Contract Documents provide walking pads from the roof hatch to each piece of equipment located on the roof.
16. Provide walking pad material for MEP trades to cut and install underneath conduit, gas line supports, etc.
17. Provide roofing and parapet mockup to be incorporated into larger mockup with other trades.
18. Provide and install roof hatches, prefabricated ladders hatch ladders, safety ups, hatch guardrails, and prefabricated rooftop ladders as indicated on the contract documents.
19. Provide and install all lumber and blocking necessary for the roof parapet, roof blocking, roof hatches, roof mounted ladders, roof penetrations, and expansion joint.
20. Provide and install cants at roof curbs.
21. Provide and install all prefabricated roof ladders and hatches and associated blocking.
22. Provide and install parapet cap at dumpster enclosure.
23. Framing and Drywall Trade Contractor shall provide blocking, sheathing, and framing associated with roof scuppers. Flashing and all weather barrier for through wall application to be provided by Roofing Trade Contractor.

Trade Package 7-3 EIFS

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **EIFS** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification 07 24 19	Water-Drainage Exterior Insulation and Finish

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of EIFS
- Crew Size (#) & Duration (Days)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.

The following is a highlight of the scope of work associated and to be included in this bid package:

a. All items listed in General Trade Package.
b. Provide and install all products per the manufacturer's recommendations.
c. Regardless if shown on the Contract Documents provide all accessories required or recommended by manufacturer for a warrantable and leak free installation.
d. Provide and install vertical expansion joint covers located within building facades.
e. Waterproofing & Flashing Coordination:
    a. The Roofing Trade Contractor will be responsible for installing the roofing membrane underneath the parapet caps.
    b. This Trade Package shall be responsible for flashing and sealing penetrations through EIFS walls. Examples of penetrations are j-boxes, hose bibs, security camera boxes, vents, etc.
    c. Trade Contractor shall be responsible for providing through wall flashing where necessary. This shall include the base of the wall, at the top of openings such as windows & doors.

    d. The Roofing Trade Contractor shall be responsible for all flashing touching the roof system, including the parapet caps. Parapet caps to be designed in such a way that sections can be removed individually, without taking off adjacent sections.
    e. Glass & Glazing Trade Contractor to furnish and install all flashings and sealants at the perimeter and within their glazing systems.

f. The Roofing Trade Contractor shall provide and install all material associated with rooftop expansion joints.
g. Provide complete EIFS system to include; fluid applied water barrier, primer/sealers, flexible membrane flashings, adhesives, polystyrene board, reinforcing mesh, trim accessories, soffit vents, base and finish coats.
h. Include fluid applied water barrier at soffits.
i. Scaffolding and hoisting related to the work. Receive, unload and provide storage of items, furnished by others and installed by this Bidder
j. Review Drawings for Flashing Transitions between different materials.
k. Flashing installed behind the EIFS system that transition to masonry should be provided by EIFS Trade Contractor.
l. Roofing counterflashing that terminates the top of a roof system should be included in the Roofing scope of work.
m. Include EIFS signs, buildouts, or blockouts as indicated
n. Exterior Facade Mockup
    a. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
    b. Approximate mockup size is 10’ tall by 12’ wide and will incorporate parapet and corner.
    c. Final design of mockup to be determined.
o. Provide all necessary lifts and scaffolding to complete this scope of work.

Trade Package 8-1: Glass & Glazing

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Glass & Glazing** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 08 41 13	Aluminum Framed Entrances and Storefronts
Specification Section 08 44 13	Glazed Aluminum Curtain Wall
Specification Section 08 51 13	Aluminum Windows
Specification Section 08 71 00	Door Hardware
Specification Section 08 71 00	Hardware Schedule
Specification Section 08 80 00	Glazing
Specification Section 08 88 53	Security Glazing

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of storefront
- Total SF of curtain wall
- Lead Time on Aluminum
- Lead Time on glass/glazing

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install aluminum framed storefront and curtain wall systems per the Contract Documents.
3. Provide all accessories necessary for a complete installation of work in this Trade Package

4. This Trade Package shall be considered as a delegated design. The Trade Contractor shall be responsible for hiring a licensed engineer registered in the state of Oklahoma to design and detail the glazing framing system of the building. Delegated designer shall size mullions, connections between mullions, and connections of mullions/glazing system to the structural support indicated by the EOR. The Trade Package's Delegated Design Engineer shall design the system to meet minimum requirements/sizing shown on the Construction Documents and Specifications unless noted otherwise by the EOR/AOR. Delegated Design Engineer shall provide submitted calculations for mullion member/connection sizing for all conditions unless specifically noted by EOR/AOR. The Trade Contractor shall be responsible for shop drawings detailing all conditions not specifically noted by EOR/AOR.
5. Any structure necessary for installation of the aluminum framing in this Trade Package that is not specifically shown on the plans shall be provided and installed by this Trade Package.
6. Waterproofing & Flashing Coordination:
    a. The Roofing Trade Contractor will be responsible for installing the roofing membrane underneath the parapet caps.
    b. The weather barrier installer shall be responsible for flashing and sealing penetrations through walls. Examples of penetrations are j-boxes, hose bibs, security camera boxes, vents, etc.
    c. The Masonry Trade Contractor is responsible for installing brick ties in a way that is acceptable by the approved weather barrier manufacturer as well as supplying and installing the material necessary for sealing the fastener penetrations.
    d. The Masonry Trade Contractor shall be responsible for providing through wall flashing where necessary at the masonry walls. This shall include the base of the wall, under brick rowlocks, at the top of openings such as windows & doors.
    e. The Masonry Trade Contractor shall be responsible for placing end dams along vertical transitions where masonry abuts other materials.
    f. The Roofing Trade Contractor shall be responsible for all flashing touching the roof system, including the parapet caps. Parapet caps to be designed in such a way that sections can be removed individually, without taking off adjacent sections.
    g. Mechanical, Plumbing, and Electrical Trade Contractors shall be responsible for providing and installing pipe portals for all rooftop penetrations associated with their work. The roofing Trade Contractor shall be responsible for the roofing membrane and flashing of pipe portals.
    h. The Waterproofing Trade Contractor shall be responsible for the sealant associated with expansion joints located within masonry.
    i. The Waterproofing Trade Contractor shall be responsible for insulating/caulking required around penetrations, hollow metal doors, and perimeter openings.
    j. Glass & Glazing Trade Contractor to furnish and install all flashings and sealants at the perimeter and within their glazing systems.
    k. The Roofing Trade Contractor shall provide and install all material associated with rooftop expansion joints.
7. Hardware Coordination (Reference Hardware Set in Specification Section 08 71 00 Hardware Schedule):
    a. Hardware indicated as an item in Specification Section 08 71 00 shall be provided by the Hardware Trade Contractor.
        i. Install shall be as follows:

1. Glass & Glazing Trade Contractor to prepare doors and frames as well as install this hardware in aluminum doors/frames.
2. Hollow Metal Door & Frame Install Trade Contractor to install all hardware in wood doors and hollow metal doors and frames.

ii. Hardware Trade Contractor to turn over hardware associated with aluminum doors to Glass & Glazing Trade Contractor for door prep. Hardware will be inventoried and accepted at time of turnover. After turnover accepting Trade Contractor shall be responsible for replacing any missing and/or unaccounted for hardware items.

b. Hardware indicated as an item by the Aluminum Door Supplier shall be provided and installed by the Glass & Glazing Trade Contractor.
c. Hardware Trade Contractor to Provide all keyed cores and keying for the project, including for doors provided by others. Examples of other types of doors are aluminum doors overhead doors and grills, overhead sectional doors, and coiling counter doors.
d. All types of door locks shall be provided with temporary construction cores from the party responsible for the lock.

8. Provide and install door operators within aluminum doors.
9. Provide and install all interior glazing. Examples are within hollow metal doors and frames, wood doors, sidelights, and vision lights.
10. Provide and install mirrors that are not within casework or identified with the toilet accessories.
11. Provide and install window films as indicated in the Contract Documents.
12. Provide and install windows in PEMB structures. Trade Contractor shall be responsible for protecting adjacent surfaces during install and providing a leak free installation.
13. Permanent cores for all doors to be provided by the Hardware Trade Contractor. Installation of these cores remains within the scope of this Trade Package.
14. Provide temporary construction cores for all doors. Temporary construction cores shall be able to be locked with a key.
15. Exterior Facade Mockup
    a. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
    b. Approximate mockup size is 10’ tall by 12’ wide and will incorporate parapet and corner.
    c. Final design of mockup to be determined.
16. Trade Contractor shall supply and install interior metal MTL1 as noted on A9-3-1 at locations such as 5/A8-1 and other similar locations following that detail or where MTL1 is noted as finish.

Trade Package 8-2: Doors, Frames, & Hardware

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Doors, Frames, & Hardware** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 08 11 13	Hollow Metal Doors & Frames
Specification Section 08 14 16	Flush Wood Doors
Specification Section 08 14 33	Stile and Rail Wood Doors
Specification Section 08 71 00	Door Hardware
Specification Section 08 7100	Hardware Schedule

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number of Wood doors
- Total number of HM doors
- Lead time for frames from approval

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Furnish, for installation by others, all materials, equipment, and accessories as shown or specified in the Contract Documents for a complete installation of the items listed in above table.
3. Provide shop drawings, submittals, and samples for all items in above table as indicated in Construction Documents.
4. Hardware Coordination:

i. Hardware indicated as an item in Specification Section 08 71 00 shall be provided by the Hardware Trade Contractor.
ii. Install shall be as follows:
    1. Glass & Glazing Trade Contractor to prepare doors and frames as well as install this hardware in aluminum doors/frames.
    2. Hollow Metal Door & Frame Install Trade Contractor to install all hardware in wood doors and hollow metal doors and frames.
iii. Hardware Trade Contractor to turn over hardware associated with aluminum doors to Glass & Glazing Trade Contractor for door prep. Hardware will be inventoried and accepted at time of turnover. After turnover accepting Trade Contractor shall be responsible for replacing any missing and/or unaccounted for hardware items.

b. Hardware indicated as an item by the Aluminum Door Supplier shall be provided and installed by the Glass & Glazing Trade Contractor.
c. Hardware Trade Contractor to Provide all keyed cores and keying for the project, including for doors provided by others. Examples of other types of doors are aluminum doors overhead doors and grills, overhead sectional doors, and coiling counter doors.
d. All types of door locks shall be provided with temporary construction cores from the party responsible for the lock. Temporary Construction Core shall be key operated type.

5. Attend a coordination meeting with the Security Trade Contractor.
6. Attend all coordination meetings regarding keying.
7. Provide all hollow metal doors, frames, and associated per the Contract Documents.
8. Provide labeling at fire rated doors and frames.
9. Clearly label all doors, frames, and hardware with the correct opening number.
10. Fabricate doors and frames to accommodate slab depressions and flooring systems.
11. Glass inserts in hollow metal will be provided by others.
12. Furnish all window lites, vision kits, and louver grills in hollow metal and wood doors.
13. Furnish all peepholes in doors per drawings.
14. Provide all hardware prep for hollow metal doors & frames as well as wood doors.
15. If required by Contract Documents, provide stickers associated with emergency exit alarms such as “Emergency Exit Only – Alarm Will Sound”.
16. Hardware sets shall be grouped and labeled pre-opening. Provide a qualified representative on site at the time of deliveries to catalog, organize, and label hardware in the Construction Manager’s designated storage area.
17. Verify and coordinate final keying of the project per the Contract Documents.
18. Provide all wood doors per Contract Documents.
19. Wood doors to be prefinished per the Contract Documents.
20. Deliver, receive, unload, inventory, hoist, and stock materials and equipment for this Trade Package. Materials shall be stocked at in areas designated by the Construction Manager.
21. Provide layout and fasten templates for in-wall blocking and backing by others. Exact locations, elevations, sections, details and attachments for the blocking requirements, as required.
22. Ensure all materials, equipment, and accessories provided conform with ADA requirements.

Trade Package 8-3: Coiling and Sectional Doors

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Coiling and Sectional Doors** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 08 33 13	Coiling Counter Doors
Specification Section 08 36 13	Overhead Section Doors

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number of coiling counter doors
- Total number of overhead section doors

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials.
- Trade Contractor shall submit project specific layout details within 25 days of Notice to Proceed to be used for in wall framing and blocking layout.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Furnish and install all materials, equipment, and accessories as shown or specified in the Contract Documents for a complete installation of the items listed in above table.
3. Provide shop drawings, submittals, and samples for all items in above table as indicated in Construction Documents.
4. Special Door Power & wiring coordination
    a. A single point of connection for power will be provided to the doors associated with this Trade Package.

b. Unless shown otherwise on the Contract Documents Electrical Trade Contractor to provide a ¾" conduit and wire from the door motor to the switch location(s).
c. The Electrical Trade Contractor will provide a ¾" conduit and wire from the door motor to the door interlock.
d. The Coiling and Sectional Door Trade Contractor will provide a step-down transformer at the motor.
e. Other wiring and conduits, including low voltage, will be provided by the Coiling and Sectional Door trade contractor.

5. Provide layout and fasten templates for in-wall blocking and backing by others. Exact locations, elevations, sections, details and attachments for the blocking requirements, as required.
6. Any structure, other than wood blocking that has been properly coordinated, necessary for installation of the doors in this Trade Package that is not specifically shown on the plans shall be provided and installed by this Trade Package.
7. Trade Contractor to provide door track , hanger bracket, hanger rods and any closet framing special to door system.
8. At penetrations for doors associated with this Trade Package provide and install fire and/or acoustical sealants/materials as necessary to maintain ratings in walls.
9. Provide interlock at overhead doors.
10. Door Hardware Trade Contractor to provide permanent cores for doors within this Trade Package. This Trade Package is responsible for providing temporary construction cores.
11. Provide temporary construction cores. Permanent cores will be provided by the Hardware Trade Contractor.
12. Provide cylinders that are compatible with cores described in the door hardware specification.
13. Hardware Coordination (Reference Hardware Set in Specification Section 08 71 00 Hardware Schedule):
    a. Hardware indicated as an item in Specification Section 08 71 00 shall be provided by the Hardware Trade Contractor.
        i. Install shall be as follows:
            1. Glass & Glazing Trade Contractor to prepare doors and frames as well as install this hardware in aluminum doors/frames.
            2. Hollow Metal Door & Frame Install Trade Contractor to install all hardware in wood doors and hollow metal doors and frames.
        ii. Hardware Trade Contractor to turn over hardware associated with aluminum doors to Glass & Glazing Trade Contractor for door prep. Hardware will be inventoried and accepted at time of turnover. After turnover accepting Trade Contractor shall be responsible for replacing any missing and/or unaccounted for hardware items.
14. Date of substantial completion shall be based off of building completion and not install completion. Trade Contractor shall be responsible for negotiating/extending warranty to cover the construction time period.

Trade Package 9-1 Cold Form Framing & Drywall

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Cold Form Framing & Drywall** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 05 40 00	Cold-Formed Metal Framing
Specification Section 06 10 53	Misc Rough Carpentry
Specification Section 06 16 00	Sheathing
Specification Section 06 64 00	Plastic Paneling
Specification Section 07 21 00	Thermal Insulation
Specification Section 07 84 13	Penetration Firestopping
Specification Section 07 84 43	Joint Firestopping
Specification Section 07 95 00	Expansion Control
Specification Section 08 11 13	Hollow Metal Doors & Frames
Specification Section 09 22 16	Non-Structural Metal Framing
Specification Section 09 29 00	Gypsum Board
Specification Section 09 51 23	Acoustical Tile Ceilings
Specification Section 09 77 23	Fabric Wrapped Panels

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of gypsum board
- Crew Size (#)

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials for project mockup.
- Trade Contractor shall supply crew with capacity to run exterior framing and exterior sheathing concurrently.

- Trade Contractor shall supply crew with capacity to run interior framing, interior drywall, and interior ceiling grid installation concurrently in different areas when schedule requires.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install all framing & sheathing at exterior walls, walls with facades, walls with parapet, walls with exterior doors, and exterior soffits and overhangs.
3. Provide plumb and square walls within tolerances listed in Contract Documents and Specifications.
4. This Trade Package shall be considered as delegated design. The Trade Contractor shall be responsible for hiring a licensed engineer registered in the state of Oklahoma to design and detail the cold form framing system of the building. Where sizes of cold form framing are indicated, the delegated design engineer shall verify sizes shown conform to the load and deflection requirements of the Construction Documents and Specifications. Sizes shown on Contract Documents shall be considered minimum sizing unless approved otherwise by EOR through written approval. Delegated Design Engineer shall provide calculations and member/connection sizing for all conditions unless specifically noted by EOR. The Trade Contractor shall be responsible for shop drawings detailing all conditions not specifically noted by EOR.
5. This Trade Package shall provide and install Glass- Fiber Reinforced Plastic Paneling at areas indicated by the specifications.
6. This Trade Package shall provide and install Fabric Wrapped Panels as indicated in drawings and specifications. Trade Contractor shall be responsible for blocking/mounting required.
7. This Trade Package shall provide and install interior expansion joints in gypsum walls and for interior expansion joints between cold form framed walls/ceilings and Pre-engineered Metal Building system.
8. This Trade Package shall provide sheathing on PEMB purlins where indicated by plans. Refer 3/A7-2 and 2/A8-1 for example of sheathing on metal purlins.
9. Refer 6/A7-2. Where cold form metal framing supports metal panel, Cold Form Framing and Drywall Trade Contractor shall provide cold form framing, insulation, metal panel and accessories to compose entire wall system. Wall Panel shall run vertically and may require horizontal hat channel or blocking not detailed in wall section 6/A8-1. Trade Contractor shall be responsible for providing and installing additional hat channel or blocking where required for complete installation.
10. Where CFMF anchors to horizontal girts, Refer 2 & 3/S3-2C, Trade Contractor shall be responsible for providing clip to girt from CFMF. At this detail, and similar conditions, Trade Contractor to provide CFMF not detailed to support exterior metal panel to top of wall.
11. Where insulation R value is indicated on plans or specifications, this shall be considered minimum R value. Insulation shall fill cavity space to prevent condensate.
12. Blocking
    a. Roof parapet cap, roof hatch blocking, and mechanical curb blocking shall be by others. Identifying, quantifying, and pricing in wall blocking is the sole responsibility of the Framing & Gypsum Trade Contractors. Blocking is a means and methods issue and therefore not shown on the drawings. Provide non-corrosive fasteners for attachment to treated lumber. Examples of blocking to be provided by the Framing & Gypsum Trade Contractor are:
        i. All in wall blocking indicated in the Contract Documents

ii. All ceiling blocking as indicated in Contract Documents
iii. Toilet partition blocking
iv. Casework
v. TV Blocking
vi. Handrails
vii. MEP Control Cabinets
viii. Marker Boards
ix. Mounting boards at communications and electrical rooms
x. Window & door lintels – Provide 2x blocking at these locations
xi. Head of storefront and curtain wall openings – Provide 2x blocking at these locations
xii. Any other items mounted on walls or a gypsum board ceiling

b. Framing Trade Contractor shall be responsible for providing and installing all in wall blocking.

13. Millwork Trade Contractor shall be responsible for providing and installing floating bracket supports as indicated by detail 16/A8-5. Millwork Trade Contractor shall install brackets in coordination with Framing Trade Contractor. Millwork Trade Contractor shall provide shop drawing indicating layout prior to installation for Framing Trade Contractor to use in wall stud framing layout.
14. Identify, quantify, and price recessed and semi-recessed items that require framed openings such as toilet paper dispensers and fire extinguisher cabinets.
15. Provide and install wood blocking around window openings as indicated by details A9-2.
16. Provide and install wall sheathing as indicated in the Contract Documents
17. Weather Barrier (Spec: 07 27 26) shall be applied by weather barrier trade contractor. This Trade Package shall be responsible for providing sheathed surface meeting requirements of the specified Fluid Applied Membrane and shall be responsible for not counter-sinking exterior sheathing screws. This Trade Package shall not be responsible for sheathing joint membrane application, sealant at details, etc but is responsible for providing firm, uniform sheathing surface, including fastener locations that can be waterproofed over.
18. Provide all layout necessary to complete the framing/drywall scope.
19. Provide all necessary lifts and scaffolding to complete the framing/drywall scope.
20. Provide kickers at strike side of all interior doors.
21. Install exterior hollow metal door and window frames in gypsum board partitions (frames provided by others). This includes receiving, unloading, keeping inventory, quantity verification, damage inspections, and distribution.
22. Verify that all door frames are square prior to gypsum board installation.
23. For walls to deck provide slip tracks and insulation as well as tooth gypsum board to abut metal decking as necessary.
24. Framing and blockouts for through wall penetrations
25. Coordinate rough-in requirements for doors and frames with electrical and security subcontractors.
26. Exterior Facade Mockup
    a. Trade Contractor shall include cost associated with a large mockup in which all facades, waterproofing, air barriers, framing, etc. are coordinated.
    b. Approximate mockup size is 10’ tall by 12’ wide and will incorporate parapet and corner.
    c. Final design of mockup to be determined.

27. Provide and install fire and smoke assembly identification at all walls where required per Contract Documents.
28. Provide and install all batt insulation and sound attenuation bats per the Contract Documents.
29. If listed as an option in the Contract Documents use tear away trim where applicable.
30. Access doors in walls or ceilings will be furnished by the subcontractor whose work is accessed by the door. Installation shall be including in the framing/drywall scope. Access door to be supplied to Framing & Gypsum Trade Contractor prior to starting work in a given area.
31. The Framing & Gypsum Trade Contractor shall be responsible for all acoustical caulking, sealant, fire stopping at the top, bottom and ends of walls. Sealing of MEP penetrations will be the responsibility of the respective trade.
32. Provide an allowance of 120 working hours as well as $5,000 for materials to repair work damaged by other trades. This time shall include all necessary taxes, insurance, overhead, profit, and other markups included. The hours will be tracked by Lingo's jobsite superintendent and the drywall & framing foreman. If it is not all used it will be credited back to Lingo on a pro-rated basis. The subcontractor's total cost for this allowance, including material, is _____(Write into bid form in section 5).
33. At locations to receive wall tile provide and install cement backer board per the Contract Documents. Wall tile shall match thickness of gypsum board framing above/adjacent to tile, or as indicated by specifications.
34. Provide and install shaft wall framing and liner per the Contract Documents.
35. Prior to framing walls coordinate with MEP Trade Contractors for size, elevation, and location of all wall openings.
36. Prior to installing gypsum board, vacuum base of wall tracks.
37. Framing and Drywall Trade Contractor shall provide blocking, sheathing, and framing associated with roof scuppers. Flashing and all weather barrier for through wall application to be provided by Roofing Trade Contractor.
38. Coordinate ceiling framing with other trades to ensure their fixtures or devices can be mounted at desired locations.
39. Coordinate rough-in requirements for doors and frames with electrical and security subcontractors.
40. Provide and install all fiberglass reinforced paneling (FRP) including sealants, trim, and adhesive.
41. Tape & bedding will be provided by the Painting Trade Contractor.
42. Provide and install acoustical ceilings as called for in the Contract Documents.
43. Provide and install closure trim for acoustical ceilings as called for in the Contract Documents.
44. Provide and install ceiling suspension systems for acoustical ceilings.
45. Provide and install all interior wall and ceiling expansion joints per Contract Documents.
46. Provide and install impact resistant gypsum board as indicated in the Contract Documents.

Trade Package 9-2: Tape, Bed, Paint

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Tape, Bed, Paint** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 09 29 00	Gypsum Board
Specification Section 09 61 13	Floor Sealers
Specification Section 09 72 19	Textile Wall Coverings
Specification Section 09 91 13	Exterior Painting
Specification Section 09 91 23	Interior Painting
Specification Section 09 93 00	Staining and Transparent Finishing
Specification Section 09 96 00	High Performance Coatings

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total sf of painted gypsum board
- Total sf of floor sealant

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

Where sequencing references two areas at one time, the contractor shall provide equipment and crew of sufficient size to complete work concurrently in each area.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide all materials, labor, and accessories to provide a complete paint, coating, and wall covering system.
3. Provide all preparation, tape, bed, and paint per the Contract Documents.
4. Provide all gypsum board assembly joint treatments and accessories.
5. Provide and install all field applied finishes listed out in specification section 09 29 00.

6. The Painting Trade Contractor shall be responsible for thoroughly reviewing the entire set of Construction Documents and including all painting work regardless if it is mentioned in Specification
7. Painting Trade Contractor to ensure proper coverage of paint is provided for color, regardless of how many coats are required in the specifications.
8. Paint doors and frames as called for in the contract documents.
9. This Trade Package shall not provide and install concrete floor sealers as indicated in the Contract Documents. This shall be provided by Polishing/Sealing Concrete Trade Package.
10. Exterior steel and floor/roof decking will be provided galvanized. Painting Trade Contractor shall be responsible for preparing galvanized surfaces for paint per the manufacturer's instructions and ensuring proper adhesion. Provide etching primers as necessary to ensure adhesion per manufacturer's instructions.
11. Pavement striping will be provided by others.
12. Provide and install all wall coverings to include fabric wall covering, dry erase wall coverings, tackable wall coverings, and rigid vinyl sheet coverings along with any associated trim and accessories.
13. Provide all metal trim associated with wall coverings.
14. Painting Trade Contractor shall be responsible for painting all items noted as exposed such as ceilings, ductwork, conduit, steel, decking, etc.
15. Where wall coverings are installed in a horizontal band they shall be installed without seams.
16. Provide and install the following interior joint sealants:
    a. Interior wall and ceiling control joints
    b. Joints between door and window frames (hollow metal) and wall surfaces
    c. Gap between hollow metal door frame and gypsum boards.
    d. Millwork Trade Contractor to provide sealants where their items meet walls.
    e. Other interior joints for which no other type of sealant is indicated.
    f. Fire stopping and sealants provided by other trade packages.
17. Trade contractor to construct and maintain a washout area in a location approved by the Construction Manager that contains all wash water to prevent pollution through the storm drain system.
18. The Signage Trade Contractor shall be responsible for the painted signage.
19. Provide and install sealed concrete floor as indicated on the Contract Documents. Polished and stained floors will be provided by another trade contractor.
20. Clean all taping mud from windows, door frames, floors, and adjacent surfaces.
21. Painting Trade Contractor will paint exposed gas and water piping with rust inhibitive paint per the Contact Documents.
22. Trade Contractor shall be responsible for high performance coatings and epoxy paints. Base bid shall be to not include epoxy coating as shown on S4-0. Alternate 01 shall be to include epoxy paints as shown for stall barn and connector 3&5/S4-0. Alternate 02 shall be to include epoxy coating for main building columns as shown on 1&4/S4-0.

Trade Package 9-3: Flooring & Tile

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Flooring & Tile** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 03 54 16	Hydraulic Cement Underlayment
Specification Section 09 30 13	Ceramic Tiling
Specification Section 09 65 13	Resilient Base and Accessories
Specification Section 09 65 36	Static-Control Resilient Flooring
Specification Section 09 68 00	Carpeting
Specification Section 12 48 13	Entrance Floor Mats and Frames

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of tile
- Total SF of Carpet

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

Where sequencing references two areas at one time, the contractor shall provide equipment and crew of sufficient size to complete work concurrently in each area.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install all tiling and associated components per the Contract Documents for a complete tile installation.
3. Provide all components and accessories of the resilient flooring and tile carpeting systems for a complete flooring installation.
4. The Tiling Trade Contractor shall be responsible for installation of waterproofing under tiles at showers and service sinks as well as areas where indicated on the Contract Documents.

5. Trade Contractor shall test all shower assemblies by means of water flooding for leaks before proceeding with tile. Trade Contractor shall be required to give Lingo 48 hour notice of such test. Lingo shall observe the test unless specifically directed in writing that it is acceptable to proceed without Lingo's observance.
6. Provide and install all Schluter trim and transitions called for in the Contract Documents and the General Notes for Tile Installation.
7. Provide and install all stone thresholds as called for in the Contract Documents.
8. Tiling Trade Contractor shall provide soft joints at all inside corners as well as sealants within and at the perimeter of their work.
9. Tiling Trade Contractor shall be responsible for installing grout sealer as indicated in the Contract Documents.
10. Provide all floor surface preparation, leveling and cleaning including all required underlayment, and patching compounds. Floor preparation is limited to the filing and leveling of all saw joints.
11. Clean tile upon completion of grouting.
12. Trade Contractor shall inspect substrate prior to commencement of work. Any deficiencies shall be reported to Construction Manager.
13. Trade Contractor is responsible for the protection of all adjacent finishes for example painted walls and ceilings, fiberglass tub shower units, and counter tops.
14. Trade Contractor to construct and maintain a washout area in a location approved by the Construction Manager that will contain all wash water to prevent pollution through the storm sewer system.
15. Provide and install walk off carpets.
16. Remove excess glue if necessary, after installation of flooring products.
17. Provide and install tile carpeting per the plans and specifications.
18. Provide and install edge strips per the Contract Documents.
19. Provide all maintenance materials as indicated in the Contract Documents.
20. Provide manufacturer's written installation recommendations along with submittals. Installation shall be provided per these instructions unless discussed and agreed upon prior to installation commencing.
21. Provide and install floor protection at walkpaths in corridors. Provide 38" wide Ram Board at all corridors and 5' into each room. Construction Manager to maintain after initial installation.
22. Sand or scarify floors to meet manufacturer's recommendations for porosity. Trade contractor shall control Dust during all sanding or scarifying activities so as to comply with OSHA guidelines and not interfere with other contractors working in the same area.
23. Provide and install one ten lb. bag of feather edge floor stone per 200sf of resilient flooring as well as carpet tile for the repair of minor slab imperfections as well as fill in concrete saw joints.. Fifty pound bags will not be accepted. Use of floor prep shall be verified by Lingo jobsite superintendent.
24. At the completion of carpet installation in a given area trade contractor shall clean and vacuum the carpet utilizing a vacuum with a mechanical brush.
25. Note: per Contract Documents, floor finishes shall extend under millwork.
26. Moisture Remediation
    a. Alternates – Provide Add/(Deduct) in alternate section of the Bid Form provided in section 00 2000 Bid Form. Testing shall be performed per manufacturer's recommendations by this trade

package. However, if acceptable to the manufacturer, Construction Manager requires Percent Relative Humidity or RH type testing.

i. Alternate 1 (Trade Package 9-3) – $_____SF Add/(Deduct) If Moisture Vapor Reduction Admixture is omitted from the project and the Resilient Flooring & Tile Carpeting Trade Contractor provides glues and floor prep necessary to install Tile Carpeting on a slab containing 86%-90% relative humidity and maintain manufacturer's warranty.

ii. Alternate 2 (Trade Package 9-3) – $_____SF Add/(Deduct) If Moisture Vapor Reduction Admixture is omitted from the project and the Resilient Flooring & Tile Carpeting Trade Contractor provides glues and floor prep necessary to install Tile Carpeting on a slab containing 91%-95% relative humidity and maintain manufacturer's warranty.

iii. Alternate 3 (Trade Package 9-3) – $_____SF Add/(Deduct) If Moisture Vapor Reduction Admixture is omitted from the project and the Resilient Flooring & Tile Carpeting Trade Contractor provides glues and floor prep necessary to install Tile Carpeting on a slab containing 96%-99% relative humidity and maintain manufacturer's warranty.

Trade Package 9-4: Resinous Flooring

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Resinous Flooring** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 09 67 23	Resinous Flooring

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of fluid applied flooring

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install all components and accessories of the fluid-applied flooring and wall base per the Contract Documents and manufacturer's recommendations for a complete installation.
3. Sand or scarify floors to meet manufacturer's recommendations for porosity. Trade contractor shall control Dust during all sanding or scarifying activities so as to comply with OSHA guidelines and not interfere with other contractors working in the same area.
4. Work areas will be broom swept prior to turning over for fluid applied flooring installation. Any surface preparation beyond this shall be the responsibility of the Fluid Applied Flooring Trade Contractor.
5. Provide and install all caulking and sealants within and at the perimeter of the fluid applied flooring.
6. Trade Contractor to include labor for the off hours application for products with High VOCs or noxious fumes that would negatively effect other trades.
7. Moisture Remediation
    a. Alternates – Provide Add/(Deduct) in alternate section of the Bid Form provided in section 00 2000 Bid Form. Testing shall be performed per manufacturer's recommendations by this trade

package. However, if acceptable to the manufacturer, Construction Manager requires Percent Relative Humidity or RH type testing.

i. Alternate 1 (Trade Package 9-4) – $_____SF Add/(Deduct) If Moisture Vapor Reduction Admixture is omitted from the project and the Fluid Applied Flooring Trade Contractor provides glues and floor prep necessary to install Fluid Applied Flooring on a slab containing 86%-90% relative humidity and maintain manufacturer's warranty.

ii. Alternate 2 (Trade Package 9-4) – $_____SF Add/(Deduct) If Moisture Vapor Reduction Admixture is omitted from the project and the Fluid Applied Flooring Trade Contractor provides glues and floor prep necessary to install Fluid Applied Flooring on a slab containing 91%-95% relative humidity and maintain manufacturer's warranty.

iii. Alternate 3 (Trade Package 9-4) – $_____SF Add/(Deduct) If Moisture Vapor Reduction Admixture is omitted from the project and the Fluid Applied Flooring Trade Contractor provides glues and floor prep necessary to install Fluid Applied Flooring on a slab containing 96%-99% relative humidity and maintain manufacturer's warranty.

8. Provide and install Ram Board floor protection at floors after installation is complete.

Trade Package 10-1: Specialties Supply

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Specialties Supply** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 10 21 13	Toilet Compartments
Specification Section 10 26 00	Wall and Door Protection
Specification Section 10 28 00	Toilet Bath and Laundry Accessories
Specification Section 10 43 13	Defibrillator Cabinets
Specification Section 10 43 14	Automated External Defibrillators
Specification Section 10 44 13	Fire Protection Cabinets
Specification Section 10 44 16	Fire Extinguishers

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Number of toilet compartments

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 15 days of Notice to Proceed to facilitate procurement of materials.
- Trade Contractor shall submit project specific layout details within 25 days of Notice to Proceed to be used for in wall framing and blocking layout.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Furnish, for installation by others, all materials and accessories associated with Specialties as shown or specified in the Contract Documents for a complete installation of the items listed in above table.
3. Provide shop drawings, submittals, and samples for all items in above table as indicated in Construction Documents.

4. Installation of doors and hardware provided in Trade Package 8-2. Frames will be installed by another Trade Contractor.
5. Hardware Coordination:
    a. Hardware indicated as an item in Specification Section 08 71 00 shall be provided by the Hardware Trade Contractor.
        i. Install shall be as follows:
            1. Glass & Glazing Trade Contractor to prepare doors and frames as well as install this hardware in aluminum doors/frames.
            2. Hollow Metal Door & Frame Install Trade Contractor to install all hardware in wood doors and hollow metal doors and frames.
        ii. Hardware Trade Contractor to turn over hardware associated with aluminum doors to Glass & Glazing Trade Contractor for door prep. Hardware will be inventoried and accepted at time of turnover. After turnover accepting Trade Contractor shall be responsible for replacing any missing and/or unaccounted for hardware items.
    b. Hardware indicated as an item by the Aluminum Door Supplier shall be provided and installed by the Glass & Glazing Trade Contractor.
    c. Hardware Trade Contractor to Provide all keyed cores and keying for the project, including for doors provided by others. Examples of other types of doors are aluminum doors overhead doors and grills, overhead sectional doors, and coiling counter doors.
    d. All types of door locks shall be provided with temporary construction cores from the party responsible for the lock. Temporary Construction Cores shall be lockable.
6. Provide toilet compartments and associated accessories per Contract Documents. Final dimensions to be verified through field dimensions provided by Construction Manager.
7. Provide toilet and janitor accessories per the Contract Documents
8. Provide Defibrillator and cabinets as specified.
9. Provide wall protection devices as called for in the Contract Documents
10. Provide Fire protection specialties and accessories per the Contract Documents.
11. Provide Fire Extinguishers inspected and ready for use.
12. Deliver, receive, unload, inventory, hoist, and stock materials and equipment for this Trade Package. Materials shall be stocked at in areas designated by the Construction Manager.
13. Provide layout and fasten templates for in-wall blocking and backing by others. Exact locations, elevations, sections, details and attachments for the blocking requirements, as required.
14. Ensure all materials, equipment, and accessories provided conform with ADA requirements.

Trade Package 10-2: Misc. & Install

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Misc & Install** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 03 30 00	Cast-in-Place Concrete
Specification Section 05 52 13	Pipe and Tube Railings
Specification Section 08 1113	Hollow Metal Doors & Frames
Specification Section 08 1416	Flush Wood Doors
Specification Section 08 7100	Door Hardware
Specification Section 08 7100	Hardware Schedule
Specification Section 10 21 13	Toilet Compartments
Specification Section 10 26 00	Wall and Door Protection
Specification Section 10 28 00	Toilet Bath and Laundry Accessories
Specification Section 10 43 13	Defibrillator Cabinets
Specification Section 10 43 14	Automated External Defibrillators
Specification Section 10 44 13	Fire Protection Cabinets
Specification Section 10 44 16	Fire Extinguishers
Specification Section 12 24 13	Roller Window Shades
Specification Section 23 05 93	Testing, Adjusting, and Balancing for HVAC

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Number of doors installed
- Number of waste bunkers

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.

2. Installation of doors and hardware provided in Trade Package 8-2. Frames will be installed by another Trade Contractor.
3. Hardware Coordination:
    a. Hardware indicated as an item in Specification Section 08 71 00 shall be provided by the Hardware Trade Contractor.
        i. Install shall be as follows:
            1. Glass & Glazing Trade Contractor to prepare doors and frames as well as install this hardware in aluminum doors/frames.
            2. Hollow Metal Door & Frame Install Trade Contractor to install all hardware in wood doors and hollow metal doors and frames.
        ii. Hardware Trade Contractor to turn over hardware associated with aluminum doors to Glass & Glazing Trade Contractor for door prep. Hardware will be inventoried and accepted at time of turnover. After turnover accepting Trade Contractor shall be responsible for replacing any missing and/or unaccounted for hardware items.
    b. Hardware indicated as an item by the Aluminum Door Supplier shall be provided and installed by the Glass & Glazing Trade Contractor.
    c. Hardware Trade Contractor to Provide all keyed cores and keying for the project, including for doors provided by others. Examples of other types of doors are aluminum doors overhead doors and grills, overhead sectional doors, and coiling counter doors.
    d. All types of door locks shall be provided with temporary construction cores from the party responsible for the lock. Temporary Construction Cores shall be lockable.
4. Commissioning & Test and Balance
    a. Test, Balance, & Commission Trade Contractor shall be 3rd Party NEBB Independent Certified. Submit certification along with bid packet.
    b. Provide testing, adjusting, and balancing for HVAC per the Contract Documents.
    c. Provide commissioning of HVAC per the Contract Documents.
    d. Include testing, adjusting, and balancing of kitchen hood system.
5. Provide and Install Pipe Railings Refer 1/A8-3,
6. Provide and Install Waste Bunkers and blocking as indicated by plans.
7. Install toilet compartments and associated accessories per Contract Documents.
8. Install toilet and janitor accessories per the Contract Documents
9. Install wall protection devices as called for in the Contract Documents
10. Install Fire protection specialties and accessories per the Contract Documents.
11. Fire Extinguishers shall be inspected and ready for use.
12. Deliver, receive, unload, inventory, hoist, and stock materials and equipment for this Trade Package. Materials shall be stocked at in areas designated by the Construction Manager.
13. Provide and Install Manual Roller Window Shades as indicated in documents.
    a. Provide and install window treatments per the Contract Documents.
    b. Field measure each opening prior to fabrication.

c. Provide layout and fasten templates for in-wall blocking and backing by others. Exact locations, elevations, sections, details and attachments for blocking requirements, as required.
d. All structure beyond what is shown in the Contract Documents necessary for a complete installation shall be included by this Trade Contractor.
e. Installers to wear clean gloves while installing so that incidental handprints are not left on the adjacent painted surfaces or ceilings.

Trade Package 10-3: Graphics & Signage

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Graphics & Signage** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 09 72 19	Textile Wall Coverings
Specification Section 10 14 00	Signage
Specification Section 10 14 19	Dimensional Letter Signage

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number room signs.
- Lead time for lettering from Notice to Proceed:

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Provide product information for illuminated signage for coordination with Electrical Trade Partner within 4 weeks of notice to proceed
- Provide Product Information for any signage requiring blocking by others by 6 weeks after notice to proceed.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. The Signage Trade Contractor will be fully responsible for all cost and work associated with obtaining the signage permits and passing associated inspections including submission, interaction with inspectors, payment of fees, and pulling the permit.
3. Provide material, labor, and equipment necessary for a complete installation of all signage as called for in the Contract Documents.
4. Examples of signage to be included in this Trade Contract are all sign types on the ROOM ID & Regulatory Signage Types as well as the Special Signage & Graphics legends located on page A9-3-2
5. Signs are required to comply with ADA Standards and ICC A117.1 unless otherwise noted.

6. Provide submittals and shop drawings for all signage.
7. Traffic, parking, and exterior convenience related signage will be provided and installed by the Paving Trade Contractor.
8. Where signs mount on glass provide blank sign/modesty panel for inside face to conceal fastening tape.
9. Provide all required mounting devices, standoffs, and fasteners for installation of the signage.
10. Provide and install lettering noted for monument signage per detail 5 & 7 on A8-2-1.
11. Provide and install signage shown on interior and exterior elevations.

Trade Package 10-4 Prefabricated Metal Canopies

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Prefabricated Metal Canopies** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification 10 73 18	Prefabricated Metal Canopies

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total SF of Canopy Decking
- Crew Size (#) & Duration (Days) for install
- Lead Time from approved shop drawings

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- Trade Contractor shall submit Product Data and manufacturer's standard details applicable to this project within 20 days of Notice to Proceed to facilitate procurement of materials for project mockup.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide all items listed in the Standard Bid Instructions For All Bidders.
3. Provide all labor, materials, delegated engineering, permits (other than the general building permit), and equipment, necessary for a complete installation of the canopies and associated materials per the Contract Documents.
4. This Trade Package shall be considered as delegated design. The Trade Contractor shall be responsible for hiring a licensed engineer registered in the state of Oklahoma to design and detail the Aluminum Walkway Covers and Cantilevered Walkway Covers and any other items necessary to complete the indicated scope of work. Sizes shown on Contract Documents shall be considered minimum sizing unless approved otherwise by EOR through written approval. Delegated Design Engineer shall provide calculations and member/connection sizing for all conditions unless

specifically noted by EOR. The Trade Contractor shall be responsible for shop drawings detailing all conditions not specifically noted by EOR.

5. Some examples of the materials to be included in this Trade Package are columns, beams, decking, gutter, struts, false fascia, flashing, and fasteners.
6. Finishes shall be as described in the specification. Alternate finishes are not accepted.
7. Trade Contractor shall be responsible for providing detailed drawings of in-wall blocking and support layout for the prefinished canopy system.

Trade Package 15-1: Fire Suppression

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Fire Suppression** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 06 10 53	Rough Carpentry
Specification Section 07 84 13	Penetration Firestopping
Specification Section 07 84 43	Joint Firestopping
Specification Section 11 40 00	Foodservice Equipment
Division 21	Fire Suppression
Specification Section 21 05 00	Common Work Results for Fire Suppression
Specification Section 21 05 53	Identification for Fire-Suppression Piping and Equipment
Specification Section 21 13 00	Fire-Suppression Sprinkler Systems

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Count for total expected sprinkler heads
- SF dry line protection system
- SF wet line protection system

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Fire Suppression Trade Contractor shall be responsible for providing a complete and working fire suppression system.
3. Provide all devices for fire suppression system including flow switches, tamper switches, and control panels.

4. The Fire Suppression Trade Contractor will be fully responsible for all cost and work associated with designing the fire alarm system, obtaining the fire alarm permits and passing associated inspections including submission, interaction with inspectors, payment of fees, and pulling the permit.
5. Fire suppression is a delegated design system. The Fire Suppression Trade Contractor shall be responsible for ensuring the system meets permitting requirements, Contract Document requirements, specified NFPA requirements, all applicable building code requirements, and fire marshal requirements as well as any other entity that qualifies as an authority having jurisdiction over the fire suppression system.
6. Fire line to be installed, by Utilities Trade Contractor, to riser room and stubbed up 2'-5'. Final coordination of fire line elevation and location to be coordinated with sprinkler contractor and CM.
7. Fire pump is not required unless noted in the Construction Documents or specifications.
8. Backflow preventers to be provided and installed by the Utilities Trade Contractor.
9. Provide sprinkler heads at confined spaces where required.
10. The Fire Suppression Trade Contractor shall furnish and install all tamper and flow switches required for their system. The Electrical and Fire Alarm Trade Contractors will be responsible for providing all conduit, wire and terminations of these devices. Commissioning will be a joint effort of the Fire Suppression and Alarm Trade Contractors.
11. Trade Contractor acknowledges that placement of heads is visually important and has reviewed notes in the specs/architectural drawings to comply with architects' comments regarding the fire sprinkler system.
12. At all locations other than exposed ceilings and back of house areas provide and install flexible sprinkler heads.
13. Install sprinkler heads in the center of ceiling tile unless shown otherwise in the Contract Documents.
14. Prior to starting the engineering/shop drawing process the Fire Suppression Trade Contractor will be required to schedule and attend a design meeting with Construction Manager and the Architect to review their requirements.
15. Fire Suppression Trade Contractor shall be responsible for identifying and including all sprinkler heads, whether shown on the plans or not. This includes obscure, code-required locations such as at an elevator pit, top of elevator shaft, and walk in cooler/freezer, overhang, obstruction, etc.
16. Fire Suppression Trade Contractor is responsible for reviewing various ceiling types and ensuring appropriate head coverage is included for each ceiling system.
17. Provide expansion joints for fire protection system where piping crosses the building expansion joint as applicable.
18. After award of the contract Fire Suppression Trade Contractor shall verify that the delivered water main pressure at the site is sufficient to meet the protection requirements. Submit flow test results for review with the sprinkler shop drawings.
19. Each area of the building must be designed in a way that it can be tested individually with pressurized air.
20. Exhaust Hood(s) Coordination
    a. Food Service Equipment Trade Contractor Responsibilities
        i. Supply and hang exhaust hoods.
        ii. Supply and install stainless steel wall paneling at hoods.
        iii. Provide and install ansul system as well as coordinate with fire marshal for inspection.
        iv. Provide all low voltage controls and wiring other than the single point of electrical connections by the Electrical Trade Contractor.
        v. Commission the hood system.

b. Mechanical Trade Contractor
    i. Provide and install the hood fans.
    ii. Provide and install grease ductwork and associated fire insulation.
    iii. Provide access doors per code and as required for access to clean.
c. Electrical Trade Contractor
    i. Provide a single point of electrical connection at each control panel and fan unless otherwise shown on the drawings.
    ii. Provide and install raceways for controls wiring from hood to makeup-air and exhaust fans.
d. Fire Alarm Trade Contractor
    i. Provide tie in of fire alarm system to ansul system.

Trade Package 15-2: Mechanical

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Mechanical** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 06 10 00	Rough Carpentry
Specification Section 07 72 00	Roof Accessories
Specification Section 07 84 13	Firestopping
Specification Section 08 31 13	Access Doors & Frames
Specification Section 11 31 00	Residential Appliances
Specification Section 11 40 00	Foodservice Equipment
Division 23	Heating Ventilating and Air Conditioning

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total LF of ductwork

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule.

- **NOTICE: To maintain project completion date, blocks in various areas will be phased concurrently. Trade Contractor will be required to provide multiple crews, equipment, material, and the leadership required to work in areas concurrently as shown in the project schedule.**

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. The Mechanical Trade Contractor will be fully responsible for all cost and work associated with obtaining the mechanical permits and passing associated inspections including submission, interaction with inspectors, payment of fees, and pulling the permit.
3. Provide a complete and working mechanical system.

4. Any structure or blocking necessary for installation of the systems in this Trade Package that is not specifically shown on the plans shall be provided and installed by this Trade Package.
5. Provide and install all heating, ventilating, and air conditioning systems.
6. Provide and install HVAC controls and associated wiring per the sequence drawings in the Contract Documents.
7. Mechanical Trade Contractor to provide and install all exhaust systems except for the kitchen exhaust.
8. Access doors in walls or ceilings will be furnished by the subcontractor whose work is accessed by the door. Installation shall be including in the framing/drywall scope. Access door to be supplied to Framing & Gypsum Trade Contractor prior to starting work in a given area.
9. Provide and install any step down transformers required for low voltage work. Electrical Trade Contractor to provide electrical connection points as shown in the Contract Documents. Anything further is the responsibility of this Trade Contract.
10. Duct detectors will be furnished by the Fire Alarm Trade Contractor to the Mechanical Trade Contractor. Mechanical Trade Contractor will mount the duct detector and provide access door in the duct for access by the Fire Alarm Trade Contractor. At exposed ceiling locations Electrical Trade Contractor will provide the conduit and the Fire Alarm Trade Contractor will complete all wiring, terminations, and commissioning of the devices.
11. Coordinate with Roofing Trade Contractor to ensure roof membrane is installed over curbs. If roofing membrane is not installed over curb Mechanical Trade Contractor to supply and install roof flashings as well as sealants for equipment over curbs.
12. Provide and install blocking as necessary to ensure mechanical roof curbs are installed at correct elevations to maintain roof install requirements.
13. Supply and install all louvers including mechanical and architectural or not. An example is the louvers for PEMB.
14. Furnish and install flues from gas-fired equipment.
15. Provide all fire, fire-smoke, and smoke dampers and associated actuators.
16. Provide all related equipment accessories including bases, supports, hangers, clips, etc.
17. Provide vibration isolation systems if called out in the Contract Documents.
18. Coordinate locations of ductwork with Electrical and Fire Sprinkler Trade Contractors.
19. Ductwork shall be delivered to jobsite with ends sealed and protected from water. If inside of ductwork becomes wet due to improper storage or water infiltration through curb openings Mechanical Trade Contractor shall remove and replace at their expense.
20. Provide and install temporary waterproof caps at all roof curbs.
21. Equipment will be required to be used during construction. Provide temporary construction filters and prefilters on equipment (change or clean when needed). Provide and install a new set of filters prior to test and balance work. If filters are not maintained during construction Mechanical Trade Contractor shall be responsible for cleaning coils prior to test and balance.
22. Provide paint grip ductwork at locations where ducts are to remain exposed and do not receive a covering. Clean and remove stickers for ductwork at these locations after installation.
23. Provide and install lockable covers at sensors
24. This trade Package shall provide and install louvers in PEMB. Trade Contractor shall be responsible for protecting adjacent finishes during installation and for providing a leak free installation. Trade Contractor responsible for controller devices and installation of operator and full system.
25. Test & balance as well as commissioning are not included within this Trade Package. Coordinate with Test & Balance Trade Contractor.
26. Residential Appliance Installation Coordination
    a. Residential Appliance Trade Contractor to deliver, unbox, and dispose of trash for residential appliances. Deliver to room in which appliance will install.

b. Residential Appliance Trade Contractor to provide all necessary install kits. Examples of items in kits are electrical whips, stacking kits, flexible dryer vents, refrigerator water lines, etc.
c. Electrical Trade Contractor to provide hardwired connections.
d. Mechanical Trade Contractor to provide hard ducted connections.
e. Plumbing Trade Contractor to provide all water and gas connections.
f. Residential Appliance Trade Contractor to make all other installations not mentioned above.

27. Exhaust Hood(s) Coordination
    a. Food Service Equipment Trade Contractor Responsibilities
        i. Supply and hang exhaust hoods.
        ii. Supply and install stainless steel wall paneling at hoods.
        iii. Provide and install ansul system as well as coordinate with fire marshal for inspection.
        iv. Provide all low voltage controls and wiring other than the single point of electrical connections by the Electrical Trade Contractor.
        v. Commission the hood system.
    b. Mechanical Trade Contractor
        i. Provide and install the hood fans.
        ii. Provide and install grease ductwork and associated fire insulation.
        iii. Provide access doors per code and as required for access to clean.
    c. Electrical Trade Contractor
        i. Provide a single point of electrical connection at each control panel and fan unless otherwise shown on the drawings.
        ii. Provide and install raceways for controls wiring from hood to makeup-air and exhaust fans.
    d. Fire Alarm Trade Contractor
        i. Provide tie in of fire alarm system to ansul system.

28. Permanent Heating & Cooling Coordination
    a. Permanent HVAC system will be required to be available to use for construction starting the December 11, 2020.
    b. For each area of the building Mechanical, Electrical, & Plumbing Trade Contractors must install all work necessary for HVAC systems to be fully functional for heat within the durations between the roof installation and gypsum board being complete.
    c. If Mechanical, Electrical or Plumbing Trade Contractors fail to finish installing and commissioning their portions of the install prior to cold weather they shall be responsible for the cost of supplying temporary heating as necessary to maintain project schedule.
    d. Construction Manager shall be responsible for coordination of Utility Service Providers and ensuring service is available by November of 2020.
    e. If the above conditions are met and Mechanical Trade Contractor refuses to start up equipment for any reason then the Mechanical Trade Contractor shall be fully responsible for providing temporary construction heating sufficient for finish trades to perform their work.
    f. The Mechanical Trade Contractor shall be responsible for ensuring that warranty term requirements indicated in the Contract Documents are met starting at substantial completion. If

the startup of equipment initiates commencement of warranty, then the Mechanical Trade Contractor shall provide extended warranty to cover time period from start to substantial completion.

Trade Package 15-3: Plumbing

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Plumbing** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 06 10 00	Rough Carpentry
Specification Section 07 72 00	Roof Accessories
Specification Section 07 84 00	Firestopping
Specification Section 08 31 00	Access Doors & Frames
Specification Section 11 30 13	Residential Appliances
Specification Section 11 40 00	Foodservice Equipment
Division 22	Plumbing

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number of plumbing fixtures

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule

- **NOTICE: To maintain project completion date, blocks in various areas will be phased concurrently. Trade Contractor will be required to provide multiple crews, equipment, material, and the leadership required to work in areas concurrently as shown in the project schedule.**

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. Provide and install all plumbing systems including, but not limited to, plumbing fixtures, plumbing equipment, propane equipment and piping, sanitary waste piping and vents, water heaters, domestic water system, storm drainage system, sump pumps, drinking fountains and water coolers, chemical waste systems, valves, tees and piping insulation.
3. Provide a complete and working plumbing system.

4. The Plumbing Trade Contractor will be fully responsible for all cost and work associated with obtaining the plumbing permits and passing associated inspections including submission, interaction with inspectors, payment of fees (other than impact fees), and pulling the permit. Construction Manager to pay the impact fees.
5. Gas provider to provide and install gas piping up to and including the meter. Plumbing Trade Contractor to provide and install gas piping continuing from the meter into and throughout the building.
6. Utility Trade Contractor shall provide and install all underground site utility systems including underground water lines (domestic water, storm sewer, sanitary sewer, fire lines), fire hydrants, thrust blocks, meters, tracer wires, and backflow preventers. All lines shall be provided up to 5' from the edge of the building at the location specified for tie-in except for the fire line. Plumbing Trade Contractor to carry lines into and distribute throughout building. The fire line shall be stubbed up inside of the fire room.
7. Final connections (at the building) for domestic water, storm sewer, roof drains, and sanitary sewer to be performed by the Plumbing contractor.
8. Plumbing Trade Contractor to provide and install all roof drainage systems from the drain body to storm drain line tie in as shown on the Contract Documents.
9. Provide and install grease interceptor and associated piping and tie ins to sanitary sewer system.
10. Plumbing Trade Contractor to excavate, install, backfill, and carry on grease line into and throughout building. Ensure backfill is performed per geotechnical recommendations. Plumbing Trade Contractor to ensure grease interceptor inlets/outlets coordinate with the invert elevations shown in the Civil Drawings.
11. Condensate drainage piping shall be provided by and installed by this Trade Package. Lines shall be routed to closest storm drain, sink p-trap, or indirect sanitary connection. Drain lines shall not be connected to roof drains that daylight over sidewalks, pavement, or public space areas unless approved otherwise.
12. Complete all sealants and caulking related to plumbing work. This includes caulking water closets to walls, sealing hose bib penetrations through exterior walls, penetrations through fire or sound rated walls (as mentioned in General Trade Package), etc.
13. Plumbing Trade Contractor to provide connections for all equipment requiring plumbing connections, even equipment not provided as part of this Trade Package. Examples include kitchen equipment, refrigerators, ice makers, dishwashers, washing machines, etc.
14. Provide and install thrust blocks, concrete, anchors, and guides for underground piping.
15. Provide all disinfectants, chlorination/flushing, and testing of domestic water systems per the Contract Documents.
16. Provide temporary water at building for construction purposes.
17. At exterior gas lines prime all exposed fittings and welds to prevent rusting. Painting Trade Contractor will paint exposed gas and water piping with rust inhibitive paint per the Contact Documents.
18. Provide regulators and valves as indicated in the Plumbing Drawings.
19. Residential Appliance Installation Coordination
    a. Residential Appliance Trade Contractor to deliver, unbox, and dispose of trash for residential appliances. Deliver to room in which appliance will install.
    b. Residential Appliance Trade Contractor to provide all necessary install kits. Examples of items in kits are electrical whips, stacking kits, flexible dryer vents, refrigerator water lines, etc.
    c. Electrical Trade Contractor to provide hardwired connections.
    d. Mechanical Trade Contractor to provide hard ducted connections.

e. Plumbing Trade Contractor to provide all water and gas connections.
f. Residential Appliance Trade Contractor to make all other installations not mentioned above.

20. Exhaust Hood(s) Coordination
    a. Food Service Equipment Trade Contractor Responsibilities
        i. Supply and hang exhaust hoods.
        ii. Supply and install stainless steel wall paneling at hoods.
        iii. Provide and install ansul system as well as coordinate with fire marshal for inspection.
        iv. Provide all low voltage controls and wiring other than the single point of electrical connections by the Electrical Trade Contractor.
        v. Commission the hood system.
    b. Mechanical Trade Contractor
        i. Provide and install the hood fans.
        ii. Provide and install grease ductwork and associated fire insulation.
        iii. Provide access doors per code and as required for access to clean.
    c. Electrical Trade Contractor
        i. Provide a single point of electrical connection at each control panel and fan unless otherwise shown on the drawings.
        ii. Provide and install raceways for controls wiring from hood to makeup-air and exhaust fans.
    d. Fire Alarm Trade Contractor
        i. Provide tie in of fire alarm system to ansul system.

21. Permanent Heating & Cooling Coordination
    a. Permanent HVAC system will be required to be available to use for construction starting the December 11, 2020.
    b. For each area of the building Mechanical, Electrical, & Plumbing Trade Contractors must install all work necessary for HVAC systems to be fully functional for heat within the durations between the roof installation and gypsum board being complete.
    c. If Mechanical, Electrical or Plumbing Trade Contractors fail to finish installing and commissioning their portions of the install prior to cold weather they shall be responsible for the cost of supplying temporary heating as necessary to maintain project schedule.
    d. Construction Manager shall be responsible for coordination of Utility Service Providers and ensuring service is available by November of 2020.
    e. If the above conditions are met and Mechanical Trade Contractor refuses to start up equipment for any reason then the Mechanical Trade Contractor shall be fully responsible for providing temporary construction heating sufficient for finish trades to perform their work.
    f. The Mechanical Trade Contractor shall be responsible for ensuring that warranty term requirements indicated in the Contract Documents are met starting at substantial completion. If the startup of equipment initiates commencement of warranty, then the Mechanical Trade Contractor shall provide extended warranty to cover time period from start to substantial completion.

Trade Package 16-1: Electrical & Fire Alarm

This bid package shall include the cost of providing all labor, material, equipment, supervision, services, insurance, fees, permits, overhead and profit, etc. necessary or incidentally required for the **Electrical** including work from referenced specifications and normally associated with this trade, whether referenced or not.

Specification Section:	Description:
Division 00	Contract & Bidding Documents
Division 01	General Requirements
Specification Section 06 1000	Rough Carpentry
Specification Section 07 72 00	Roof Accessories
Specification Section 07 84 13	Penetration Firestopping
Specification Section 07 84 43	Joint Firestopping
Specification Section 08 31 13	Access Doors and Frames
Specification Section 08 33 13	Coiling Counter Doors
Specification Section 08 36 13	Sectional Doors
Specification Section 08 95 16	Wall Vents
Specification Section 10 14 00	Signage
Specification Section 10 14 19	Dimensional Letter Signage
Specification Section 08 71 00	Door Hardware
Specification Section 08 71 00	Hardware Schedule
Specification Section 11 31 00	Residential Appliances
Specification Section 11 40 00	Foodservice Equipment
Division 23	Heating, Ventilating, and Air Conditioning
Division 26	Electrical
Specification Section 28 31 00	Fire Detection and Alarm

Quantity Check: On section #5 of the bid form please list total anticipated quantities for the following in the quantity check section:

- Total number of light fixtures

These quantities are for reference only. Trade contractor is responsible for the actual quantities, not anticipated.

Schedule: This section is a highlight of the durations and activities that pertain to the project. Bidders shall ensure size and number of crews, equipment, and materials are sufficient to meet highlights below as well as durations from schedule

- **NOTICE: To maintain project completion date, blocks in various areas will be phased concurrently. Trade Contractor will be required to provide multiple crews, equipment,**

material, and the leadership required to work in areas concurrently as shown in the project schedule.

The following is a highlight of the scope of work associated and to be included in this bid package:

1. All items listed in General Trade Package.
2. The Electrical Trade Contractor will be fully responsible for all cost and work associated with obtaining the electrical permits and passing associated inspections including submission, interaction with inspectors, payment of fees, and pulling the permit.
3. Provide a complete and working electrical system.
4. Provide complete building and site electrical systems as indicated in the Contract Document including, but not limited to, electrical, services, distribution, power, lighting, grounding, communications, electronic safety and security, and emergency power.
5. Trade Contractor to perform all trenching, backfill, cabling, sleeving, and other work necessary for site electrical work.
6. Transformer pads will be provided by the Concrete Trade Contractor.
7. Provide and install underground conduits from the transformer to OG&E tie in point.
8. Provide disconnect switches, starters, and VFD's that are not identified to be furnished by the Mechanical, Plumbing, and Fire Protection Trade Contractors.
9. Electrical Trade Contractor to provide all power and wiring to and installation of all motors, controllers, VFD's, starters and disconnects provided by the Mechanical, Plumbing, and Fire Protection Trade Contractors.
10. Test all breakers.
11. Any structure or blocking necessary for installation of the systems in this Trade Package that is not specifically shown on the plans shall be provided and installed by this Trade Package.
12. Provide power and electrical terminations to all fire, fire-smoke, and smoke dampers and associated actuators.
13. Temporary power & lighting
    a. Electrical Trade Contractor to provide additional conduit from permanent transformer pad for service equipment as necessary to provide temporary construction power.
    b. Provide adequate temporary service for the project, including the following:
    c. Provide spider boxes throughout building for temporary power. Minimum two in each area of the building.
    d. The Electrical Trade Contractor will provide, maintain, and remove temporary construction lighting throughout the building. Corridors and egress lighting to be provided and must be fully illuminated. Access lighting shall be provided such that each room may be safely accessed without additional lighting source.
    e. Upon award of project, and as temporary power allows, provide and install five temporary exterior flood lights and poles for jobsite security.
    f. Demo and remove existing temporary power serving CM's construction trailer at the end of the project.
    g. Demo and remove all temporary power, conduit, and wiring included in this Trade Package.
    h. Provide main breaker and over current protection
14. The following low voltage work is the responsibility of the Electrical Trade Contractor. They shall provide work as indicated and/or retain the services of and coordinate qualified lower tier Trade Contractors.
    a. Conduits Raceways & Cable Trays For Low Voltage Systems

i. The Electrical Trade Contractor shall be responsible for installation of all conduits, with pull strings and labels, and cable trays for low voltage systems specifically identified on the Contract Documents.
ii. The Electrical Trade Contractor shall be responsible for installing all outlet boxes and conduit stub-ups for low voltage systems.
iii. Electrical Trade Contractor to provide conduit raceways anywhere low voltage wiring is run in a non-accessible space, such as in a wall cavity or above a gypsum board ceiling.
iv. Electrical Trade Contractor to provide conduit raceways at exposed ceilings as indicated on the Contract Documents.
v. Associated Low Voltage Trade Contractor to provide and install j-hook or other individual support anywhere that a cable tray or conduit does not occur, such as above lay-in ceiling grids.
vi. If j-hooks are utilized in plenum space then plenum rated cables shall be provided.

b. Communications Trade Package
    i. Structured Telecommunications Cabling System:
        1. Provide and install Structured Telecommunications Cabling Systems per the Contract Documents.
        2. Electrical Trade Contractor to provide and install underground exterior pathways and conduits per the Contract Documents.
        3. If required, Electrical Trade Contractor to ground cable trays and equipment racks.

c. Safety and Security
    i. Fire-Alarm and Emergency Communications System
        1. The Fire Alarm Trade Contractor (This Trade Package) will be fully responsible for all cost and work associated with designing the fire alarm system, obtaining the fire alarm permits and passing associated inspections including submission, interaction with inspectors, payment of fees, and pulling the permit.
        2. Fire alarm is a delegated design system. The Fire Alarm Trade Contractor shall be responsible for ensuring the system meets permitting requirements, code requirements, Contract Document requirements, and fire marshal requirements as well as any other entity that qualifies as an authority having jurisdiction over the fire alarm system.
        3. Duct detectors will be furnished by the Fire Alarm Trade Contractor to the Mechanical Trade Contractor. Mechanical Trade Contractor will mount the duct detector and provide access door in the duct for access by the Fire Alarm Trade Contractor. At exposed ceiling locations Electrical Trade Contractor will provide the conduit and the Fire Alarm Trade Contractor will complete all wiring, terminations, test stations, and commissioning of the devices.
        4. The Fire Alarm Trade Contractor will maintain responsibility for wiring and tie-in of devices, provided by others, which are required to be monitored by the fire alarm systems. Examples of these types of systems are tamper switches, flow switches, connection to the elevator, connection to automated fire doors, access control doors, etc.
    ii. Provide and install Video Surveillance per the Contract Documents.
    iii. Provide and install Intrusion Detection per the Contract Documents.
    iv. Provide and install Door Entry System per the Contract Documents.

19. Provide and install electrical conduit, cabling, and outlets required for site lighting, irrigation controllers, irrigation backflow preventer heat tape and associated outlets, and landscaping requirements.
20. Residential Appliance Installation Coordination

a. Residential Appliance Trade Contractor to deliver, unbox, and dispose of trash for residential appliances. Deliver to room in which appliance will install.
b. Residential Appliance Trade Contractor to provide all necessary install kits. Examples of items in kits are electrical whips, stacking kits, flexible dryer vents, flexible gas connection lines, refrigerator water lines, etc.
c. Electrical Trade Contractor to provide hardwired connections.
d. Mechanical Trade Contractor to provide hard ducted connections.
e. Plumbing Trade Contractor to provide all water and gas connections.
f. Residential Appliance Trade Contractor to make all other installations not mentioned above.
g. Mechanical Trade Contractor to supply and install residential style hoods.

15. Exhaust Hood(s) Coordination
    a. Food Service Equipment Trade Contractor Responsibilities
        i. Supply and hang exhaust hoods.
        ii. Supply and install stainless steel wall paneling at hoods.
        iii. Provide and install ansul system as well as coordinate with fire marshal for inspection.
        iv. Provide all low voltage controls and wiring other than the single point of electrical connections by the Electrical Trade Contractor.
        v. Commission the hood system.
    b. Mechanical Trade Contractor
        i. Provide and install the hood fans.
        ii. Provide and install grease ductwork and associated fire insulation.
        iii. Provide access doors per code and as required for access to clean.
    c. Electrical Trade Contractor
        i. Provide a single point of electrical connection at each control panel and fan unless otherwise shown on the drawings.
        ii. Provide and install raceways for controls wiring from hood to makeup-air and exhaust fans.
    d. Fire Alarm Trade Contractor
        i. Provide tie in of fire alarm system to ansul system.
16. Permanent Heating & Cooling Coordination
    a. Permanent HVAC system will be required to be available to use for construction starting the December 11, 2020.
    b. For each area of the building Mechanical, Electrical, & Plumbing Trade Contractors must install all work necessary for HVAC systems to be fully functional for heat within the durations between the roof installation and gypsum board being complete.
    c. If Mechanical, Electrical or Plumbing Trade Contractors fail to finish installing and commissioning their portions of the install prior to cold weather they shall be responsible for the cost of supplying temporary heating as necessary to maintain project schedule.
    d. Construction Manager shall be responsible for coordination of Utility Service Providers and ensuring service is available by November of 2020.

e. If the above conditions are met and Mechanical Trade Contractor refuses to start up equipment for any reason then the Mechanical Trade Contractor shall be fully responsible for providing temporary construction heating sufficient for finish trades to perform their work.
f. The Mechanical Trade Contractor shall be responsible for ensuring that warranty term requirements indicated in the Contract Documents are met starting at substantial completion. If the startup of equipment initiates commencement of warranty, then the Mechanical Trade Contractor shall provide extended warranty to cover time period from start to substantial completion.

CANADIAN COUNTY
EXPO CENTER

3001 JENSEN ROAD EAST, EL RENO, OK 73036

PROJECT MANUAL
100% CONSTRUCTION SET

MARCH 20, 2020

POPULOUS®

DRAWING PEOPLE TOGETHER®

SECTION 00 01 05.1 – ARCHITECTURAL CERTIFICATION

1.1 CERTIFICATION

I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

00 01 00	COVER
01 01 10	TABLE OF CONTENTS
01 10 00	SUMMARY
01 23 00	ALTERNATES
01 25 00	SUBSTITUTION PROCEDURES
01 25 01	SUBSTITUTION REQUEST FORM
01 26 00	CONTRACT MODIFICATION PROCEDURES
01 29 00	PAYMENT PROCEDURES
01 31 00	PROJECT MANAGEMENT AND COORDINATION
01 31 01	ELECTRONIC DATA TRANSFER AGREEMENT FORM
01 31 02	REQUEST FOR INFORMATION FORM
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
01 33 00	SUBMITTAL PROCEDURES
01 33 01	SUBMITTAL TRANSMITTAL FORM
01 40 00	QUALITY REQUIREMENTS
01 42 00	REFERENCES
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 60 00	PRODUCT REQUIREMENTS
01 73 00	EXECUTION
01 77 00	CLOSEOUT PROCEDURES
01 78 23	OPERATION AND MAINTENANCE DATA
01 78 39	PROJECT RECORD DOCUMENTS
01 79 00	DEMONSTRATION AND TRAINING
03 35 43	POLISHED CONCRETE FINISHING
03 54 16	HYDRAULIC CEMENT UNDERLAYMENT
04 20 00	UNIT MASONRY
04 21 13.23	ADHERED BRICK VENEER
04 72 00	CAST STONE MASONRY
05 52 13	PIPE AND TUBE RAILINGS
06 10 53	MISCELLANEOUS ROUGH CARPENTRY
06 16 00	SHEATHING
06 20 13	EXTERIOR FINISH CARPENTRY
06 20 23	INTERIOR FINISH CARPENTRY
06 41 16	PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS
06 64 00	PLASTIC PANELING
07 13 26	SELF-ADHERING SHEET WATERPROOFING
07 19 00	WATER REPELLENTS
07 21 00	THERMAL INSULATION
07 21 11	PRE-ENGINEERED BUILDING INSULATION
07 21 19	FOAMED-IN-PLACE INSULATION
07 24 19	WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)
07 27 26	FLUID-APPLIED MEMBRANE AIR BARRIERS
07 41 13.16	STANDING-SEAM METAL ROOF PANELS

07 42 13.53	METAL SOFFIT PANELS
07 54 23	THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
07 62 00	SHEET METAL FLASHING AND TRIM
07 71 00	ROOF SPECIALTIES
07 71 29	MANUFACTURED ROOF EXPANSION JOINTS
07 72 00	ROOF ACCESSORIES
07 72 53	SNOW GUARDS
07 84 13	PENETRATION FIRESTOPPING
07 84 43	JOINT FIRESTOPPING
07 92 00	JOINT SEALANTS
07 95 00	EXPANSION CONTROL
08 11 13	HOLLOW METAL DOORS AND FRAMES
08 14 16	FLUSH WOOD DOORS
08 14 33	STILE AND RAIL WOOD DOORS
08 31 13	ACCESS DOORS AND FRAMES
08 33 13	COILING COUNTER DOORS
08 36 13	SECTIONAL DOORS
08 41 13	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
08 44 13	GLAZED ALUMINUM CURTAIN WALLS
08 51 13	ALUMINUM WINDOWS
08 56 53	SECURITY WINDOWS
08 71 00	DOOR HARDWARE
08 80 00	GLAZING
08 88 53	SECURITY GLAZING
08 91 19	FIXED LOUVERS
08 95 16	WALL VENTS
09 22 16	NON-STRUCTURAL METAL FRAMING
09 29 00	GYPSUM BOARD
09 30 13	TILE
09 51 23	ACOUSTICAL TILE CEILINGS
09 61 13	FLOOR SEALERS
09 65 13	RESILIENT BASE AND ACCESSORIES
09 65 36	STATIC-CONTROL RESILIENT FLOORING
09 67 23	RESINOUS FLOORING
09 68 00	CARPETING
07 72 19	GRAPHICS WALL COVERINGS
09 77 23	FABRIC-WRAPPED PANELS
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING
09 93 00	STAINING AND TRANSPARENT FINISHING
09 96 00	HIGH-PERFORMANCE COATINGS
10 14 00	SIGNAGE
10 14 19	DIMENSIONAL LETTER SIGNAGE
10 21 13.19	PLASTIC TOILET COMPARTMENTS
10 26 00	WALL AND DOOR PROTECTION
10 28 00	TOILET, BATH AND LAUNDRY ACCESSORIES
10 43 13	DEFIBRILLATOR CABINETS
10 43 14	AUTOMATED EXTERNAL DEFIBRILLATORS
10 44 13	FIRE PROTECTION CABINETS
10 44 16	FIRE EXTINGUISHERS
10 73 18	PREFABRICATED METAL CANOPIES
10 75 16	GROUND-SET FLAGPOLES
10 81 13	BIRD CONTROL DEVICES
11 12 00	PARKING CONTROL EQUIPMENT
11 24 19	FACILITY FALL PROTECTION
11 31 00	RESIDENTIAL APPLIANCES

12 24 13	ROLLER WINDOW SHADES
12 36 16	METAL COUNTERTOPS
12 36 61	SIMULATED STONE COUNTERTOPS
12 48 13	ENTRANCE FLOOR MATS AND FRAMES
13 34 19	METAL BUILDING SYSTEMS
31 31 16	TERMITE CONTROL
32 14 00	UNIT PAVING
32 15 43	EQUESTRIAN ARENA AGGREGATE SURFACING
32 18 16	EQUINE PROTECTIVE SURFACING SYSTEM
32 31 13	CHAIN LINK FENCES AND GATES
32 31 19	DECORATIVE METAL FENCES AND GATES

1.2 PROFESSIONAL SEAL

Signature: _____ Date: _____

THIS IS INTENTIONALLY LEFT BLANK

SECTION 00 01 05.2 – CIVIL CERTIFICATION

1.1 CERTIFICATION

I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

31 10 00 Site Clearing
31 20 00 Earth Moving
32 40 10 Water Distribution
32 40 20 Sanitary Sewerage
32 40 30 Storm Drainage
32 50 10 Hot Mix Asphalt Paving
32 50 15 Cement Concrete Pavement
32 50 20 Pavement Joint Sealants

1.2 PROFESSIONAL SEAL

Signature: _____ Date: 3/20/2020

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SECTION 00 01 05.3 – LANDSCAPE CERTIFICATION

1.1 CERTIFICATION

I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

32 92 00 Turf and Grasses
32 93 00 Plants

1.2 PROFESSIONAL SEAL

Signature: _____ Date: 3.20.2020

THIS IS INTENTIONALLY LEFT BLANK

SECTION 00 01 05.4 – STRUCTURAL CERTIFICATION

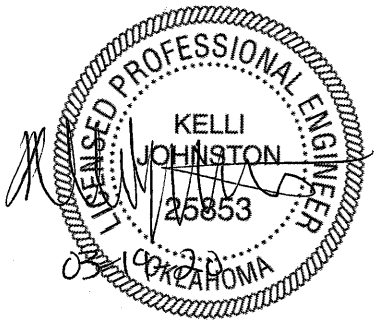
1.1 CERTIFICATION

I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

03 30 00	CAST-IN-PLACE CONCRETE
05 12 00	STRUCTURAL STEEL
05 21 00	STEEL JOISTS
05 31 00	STEEL DECK
05 40 00	COLD-FORMED METAL FRAMING
05 50 00	METAL FABRICATIONS
07 26 00	VAPOR RETARDER

1.2 PROFESSIONAL SEAL



KFC engineering
Kirkpatrick Forest Curtis PC
Structural Engineering
OK CA #3888, EXP. 06/30/21
525 Central Park Drive, Suite 202
Oklahoma City, OK 73105
Telephone: 405.528.4596
Fax: 405.528.4580

Signature: Kelli Johnston Date: 03-19-20

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SECTION 00 01 05.5 – PLUMBING CERTIFICATION

1.1 CERTIFICATION

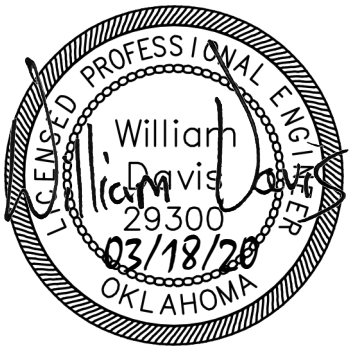
I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

22 05 00	Common Work Results for Plumbing
22 05 13	Common Motor Requirements for Plumbing Equipment
22 05 16	Expansion Fittings and Loops for Plumbing Piping
22 05 19	Meters and Gages for Plumbing Piping
22 05 48	Vibration Controls for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 10 05	Plumbing Piping
22 10 06	Plumbing Piping Specialties
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

1.2 PROFESSIONAL SEAL

Engineer of Record
Divisions 21, 22, 23
William Davis, P.E.
Mechanical Engineer
MEP Associates, LLC
OK 29300 / EXP 11.30.2021
COA.5121 / EXP 06.30.2021



Signature: _____ Date: _____

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SECTION 00 01 05.6 – MECHANICAL CERTIFICATION

1.1 CERTIFICATION

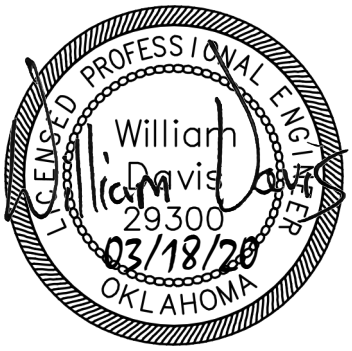
I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

23 05 00 Common Work Results for HVAC
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 14 Variable Frequency Drives
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing for HVAC
23 07 00 HVAC Insulation
23 09 13 Instrumentation and Control Devices for HVAC
23 09 23 Direct Digital Control System for HVAC
23 09 93 Sequence of Operation for HVAC Controls
23 31 00 HVAC Ducts and Casings
23 33 00 Air Duct Accessories
23 34 00 HVAC Fans
23 37 13 Diffusers, Registers and Grilles
23 41 00 Particulate Air Filtration
23 55 00 Fuel-Fired Heaters
23 74 13 Packaged Rooftop Units
23 81 27 Small Split-System Heating and Cooling

1.2 PROFESSIONAL SEAL

Engineer of Record
Divisions 21, 22, 23
William Davis, P.E.
Mechanical Engineer
MEP Associates, LLC
OK 29300 / EXP 11.30.2021
COA.5121 / EXP 06.30.2021



Signature: _____ Date: _____

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SECTION 00 01 05.7 – ELECTRICAL CERTIFICATION

1.1 CERTIFICATION

I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

26 05 00 Common Work Results for Electrical
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 23 Control-Voltage Electrical Power Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 29 Hangers and Supports for Electrical Systems
26 05 33 Raceway and Boxes for Electrical Systems
26 05 53 Identification for Electrical Systems
26 05 73 Short Circuit Coordination Study and Arc Flash Hazard Study
26 22 00 Low-Voltage Transformers
26 24 13 Switchboards
26 24 16 Panelboards
26 27 02 Equipment Wiring Systems
26 27 26 Wiring Devices
26 27 28 Disconnect Switches
26 41 00 Facility Lightning Protection
26 43 13 Surge Protective Devices for Low-Voltage Electrical Power Circuits
26 51 13 Interior Lighting Fixtures, Lamps, and Ballasts
26 51 15 Low Voltage Lighting Control
26 56 29 Site Lighting
28 31 00 Fire Detection and Alarm

1.2 PROFESSIONAL SEAL

Engineer of Record
Divisions 26, 28
Christopher Todd Mosteiro, P.E.
Electrical Engineer
MEP Associates, LLC
OK 29624 / EXP 09.30.2020
COA.5121 / EXP 06.30.2021

Signature: _____ Date: _____

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SECTION 00 01 05.9 – FIRE PROTECTION CERTIFICATION

1.1 CERTIFICATION

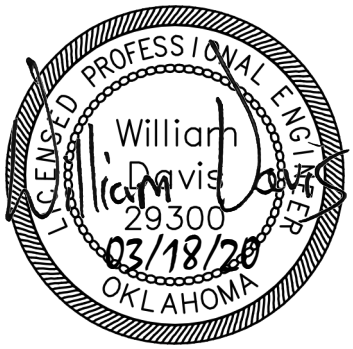
I hereby certify that these Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge, these Specifications are as required by and in compliance with Building Codes of the State of Oklahoma.

I hereby specify that the documents intended to be authenticated by my seal are limited to:

21 05 00	Common Work Results for Fire Suppression
21 05 53	Identification for Fire Suppression Piping and Equipment
21 13 00	Fire Suppression Sprinklers

1.2 PROFESSIONAL SEAL

Engineer of Record
Divisions 21, 22, 23
William Davis, P.E.
Mechanical Engineer
MEP Associates, LLC
OK 29300 / EXP 11.30.2021
COA.5121 / EXP 06.30.2021



Signature: _____ Date: _____

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SECTION 00 01 10 – TABLE OF CONTENTS

DIVISION 5 – METALS

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

DIVISION 7 – MOISTURE PROTECTION

DIVISION 8 – OPENINGS

END OF TABLE OF CONTENTS

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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Work under separate contracts.
5. Purchase contracts.
6. Owner-furnished, Contractor-installed products.
7. Access to site.
8. Coordination with occupants.
9. Work restrictions.
10. Specification and drawing conventions.
11. Miscellaneous provisions.

B. Related Requirements:
1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Canadian County Expo Center; POPULOUS project number 18.4703.
1. Project Location:3001 Jensen Road East, El Reno, Oklahoma 73036.

B. Owner: Canadian County Public Facilities Authority, Canadian County Courthouse, 201 N. Choctaw Ave. El Reno, OK 73036.
1. Owner's Representative: Dave Anderson; andersond@canadiancounty.org.

C. Architect: POPULOUS.
1. Architect's Representative: Todd Gralla; todd.gralla@populous.com.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Civil: Halff Associates, Inc.; Scott Barrett; sbarrett@halff.com.
2. Structural: KFC Engineering; Larry Curtis, lcurtis@kfcengr.com.
3. Mechanical/Electrical/Plumbing: MEP Associates, LLC; Art Lantagne, art.lantagne@salasobrien.com.
4. Food Service: S2O Consultants, Inc.; Tracy Taraski, tracy@s2oconsultants.net.

E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Geotechnical Engineering: Nasir Marakah, P.E. METCO (Midwest Engineering and Testing Corporation) has prepared the following portions of the Contract Documents:
a. Geotechnical Investigation Report.

F. Construction Manager: Lingo Construction Services; Stan Lingo, slingo@buildwithlingo.com.
1. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

G. Web-Based Project Software: Project software administered by Architect will be used for purposes of managing communication and documents during the construction stage.
1. See Section 01 31 00 "Project Management and Coordination" for requirements for establishing, administering, and using the Project Web site.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. General: The Work of Project is defined by the Contract Documents and consists of the development of approximately 50 acres to create a new home for the Canadian County Fairgrounds, with expanded programming to include expo, equine, livestock, and more events throughout the year.
   1. Main Building: Fully conditioned; single-story; primary occupancy type A-4, secondary occupancy types A-3, B, and S; ~80,000 SF arena with expo hall, office suite, and support spaces.
   2. Maintenance Building: Non-sprinklered; occupancy type S-1; ~4,300 SF.
   3. Stall Barn: Alternate No. 1; open-sided, fully-sprinklered metal building structure.
   4. Site: Plaza and parking area; gravel parking and carnival area; circulation for trailers and other large equipment; 20 RV parking spaces; other site improvements indicated on Drawings.

B. Type of Contract:
   1. Project will be constructed under a single prime contract.

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 PURCHASE CONTRACTS

A. General: Where Owner has negotiated purchase contracts with suppliers of material and equipment, Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
   1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

1.7 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:
   1. Owner will furnish and install all equipment, including:
      a. Portable bleachers
      b. All arena railing, paneling, and associated equipment
      c. All barn stalling panels and associated equipment
      d. All livestock penning, paneling, railing, and associated equipment
      e. All furniture, fixtures, and equipment. Including the office suite, storage racks, and any stage related equipment.

1.8 OWNER-FURNISHED, CONTRACTOR INSTALLED PRODUCTS

A. Owner-furnished, contractor installed products:
   1. Owner will furnish and contractor will install all equipment, including:
      a. Food service & kitchen equipment.

1.9 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.10 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
   3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.11 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.
   1. Weekend Hours: Contractor to coordinate weekend hours with Owner for restrictions.
   2. Hours for Utility Shutdowns: Contractor to coordinate utility shutdown hours with Owner for restrictions.
   3. Work may be performed during the entire twenty-four (24) hours of any day of the week with the prior approval and scheduling with Contractor and Owner.
   4. Work Operations shall comply with all applicable laws, ordinances, and regulations, and not create a public nuisance nor disturb the peace.
   5. Compensation to Contractor for supervisory staff due to abnormal working hours will be at the requesting Subcontractor's expense.
   6. Whenever Subcontractor intends to depart from normal work hours, he shall notify Contractor in writing at least forty-eight (48) hours in advance. Failure of Subcontractor to give such time notice may result in Contractor directing the removal or uncovering of the Work performed during such abnormal hours at the Subcontractor's expense. Special arrangements can be made for emergency work or shutdowns as may be required.

C. Required Off-Hours Work:
   1. Subcontractors may be requested to work split shifts, weekends, off peak Owner loading periods, etc., to accommodate Owner's utility and service requirements, such as but not limited to, electrical power, HVAC systems, storm and sanitary lines.

D. Existing Utility Interruptions: Once Owner had taken occupancy of an area, do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than seven calendar days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1.1: Addition of Stall Barn with primed and painted steel frame.
   1. Base Bid: Project complete without Stall Barn, covered connector and other associated elements. Provide Bermuda grass within the designated alternate area, which includes all ground within the surrounding concrete curb.
   2. Alternate: Addition of Stall Barn and associated elements include the following:
      a. Steel structural framing (primed and painted as specified), roof, and screen walls.
      b. Covered connector, including the structure, building elements, paving and rubber flooring.
      c. Waste bunkers around stall barn.

d. Mechanical, electrical, plumbing, and fire protection associated with the stall barn.
e. Other related Stall Barn work results as indicated on Drawings.

B. Alternate No. 1.2: Addition of Stall Barn with galvanized steel frame.
1. Base Bid: Project complete without Stall Barn, covered connector and other associated elements. Provide Bermuda grass within the designated alternate area, which includes all ground within the surrounding concrete curb.
2. Alternate: Addition of Stall Barn and associated elements include the following:
a. Zinc-coated (galvanized) steel structural framing.
b. Roof, and screen walls.
c. Covered connector, including the structure, building elements, paving and rubber flooring.
d. Waste bunkers around stall barn.
e. Mechanical, electrical, plumbing, and fire protection associated with the stall barn.
f. Other related Stall Barn work results as indicated on Drawings.

C. Alternate No. 2: Galvanized structural steel of Main Building.
1. Base Bid: Primed and painted structural steel framing.
2. Alternate: Zinc-coated (galvanized) protection for the following structural steel of pre-engineered metal building (Main Building).
a. Primary framing.
b. End-wall framing.
c. Secondary framing.
d. Perpendicular lateral frames.
e. Bolts and other connections.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 01 23 00 "Alternates" for products selected under an alternate.
   2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit each request electronically for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use facsimile of form provided in Project Manual.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven business days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 business days of receipt of request, or seven business days of receipt of additional information or documentation, whichever is later, unless a longer review is reasonably necessary and authorized by Owner.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Do not submit product substitutions as shop drawings.

B. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 business days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.

d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within a timely manner but no later than 15 business days prior to time received for preparation and review of related submittals; unless a longer review is reasonably necessary and authorized by Owner.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION

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REQUEST FOR SUBSTITUTION

RFS No.: 01 25 01.01

Project	<Project Name> <Project Number>	Date	Click here to enter a date.
Subject	**Click here to enter text.**	RFS No.	**01 25 01.01**
Contractor		Contract for	Click here to enter text.
Firm	Click here to enter text.		
Contact	Click here to enter text.		
Phone	Click here to enter text.		
E-mail	Click here to enter text.		

PRODUCT, MATERIAL, OR EQUIPMENT REQUIRED BY THE CONTRACT DOCUMENTS

Describe Product, Material or Equipment currently specified. Include Manufacturer, Model No., Product Name, etc., as well as. where it is currently indicated to be used:

Click here to enter text.

Section No. / Paragraph No.: Click here to enter text.

Drawing No / Detail No.: Click here to enter text.

REASON FOR SUBSTITUTION

Describe how this substitution benefits the project. If for convenience, include cost and time benefit in *Cost and Schedule Impact* section below. If no cost or schedule benefit, explain cause for substitution.

Click here to enter text.

Substitution Type

☐ For Cause

☐ For Convenience

COST AND SCHEDULE IMPACT

Describe the impact the proposed substitution will have on the work schedule in comparison to the work schedule without approval of the proposed substitution:

Contract Time will:

☐ Remain Unchanged
☐ Increase by Click here to enter text. Days
☐ Decrease by Click here to enter text. Days

Define cost impact of the proposed substitution in relation to the originally specified item, including related modifications required to other Work:

Contract Price will:

☐ Remain Unchanged
☐ Increase by Click here to enter text. Dollars
☐ Decrease by Click here to enter text. Dollars

POPULOUS®

REQUEST FOR SUBSTITUTION

RFS No.: 01 25 01.01

PRODUCT, MATERIAL, OR EQUIPMENT BEING REQUESTED FOR SUBSTITUTION

Describe Product, Material or Equipment being proposed for substitution. Include Manufacturer, Model No., Product Name, etc.:

Click here to enter text.

Describe similar installations and applications and identify responsible parties:

Click here to enter text.

Summarize significant differences in qualities of size, weight, durability, performance, and visual effect (ATTACH DETAILED COMPARISON):

Click here to enter text.

Describe changes required in other elements of the Work to accommodate the proposed substitution, including work performed by the Owner and separate contractors:

Click here to enter text.

Attachments

- ☐ Drawings
- ☐ Product Data
- ☐ Samples
- ☐ Test Reports
- ☐ Research and Evaluation Reports
- ☐ Sample Warranty
- ☐ Other: Click here to enter text.

Product History in area local to Project

- ☐ New Product
- ☐ 1-4 years
- ☐ 5-10 years
- ☐ More than 10 years

CONTRACTOR'S CERTIFICATION AND WAIVER:

Permission to make any substitution after Award of Contract shall be effected by Change Order. Change Order shall not relieve the Contractor, any subcontractor, or manufacturer, fabricator, or supplier from the responsibility for any deficiency that may exist in the substituted product or any departures or deviations from the Contract Documents as modified by such Change Order. Except as otherwise expressly specified by the Contractor in the Request for Substitution and expressly approved in such Change Order, the Contractor warrants that the proposed substitution satisfies all standards and requirements established by the original product, material or equipment specified and the Change Order shall not be deemed to modify the Contract Documents with respect thereto. If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work shall be considered as an essential part of the proposed substitution, to be accomplished by the Contractor without additional expense to the Owner if and when accepted.

Contractor's Signature _____ Date Click here to enter a date.

☐ Detailed comparison attached (REQUIRED BY A/E)

POPULOUS®

REQUEST FOR SUBSTITUTION

RFS No.: 01 25 01.01

A/E'S REVIEW AND RECOMMENDATION:

☐ Not Reviewed: See Comments below ☐ Insufficient Information / Incomplete Submittal: Use Specified Product or Resubmit information per Section 01 25 00 – Substitution Requests and as noted below ☐ Recommend Acceptance: Submit in accordance with Contract Documents and as noted below ☐ Recommend Rejection: Use Specified Product
Comments:
Signature _____ Date _____

OWNER'S REVIEW AND ACTION:

☐ Accepted: Submit in accordance with Contract Documents and as noted below. ☐ Rejected: Use Specified Product
Comments:
Signature _____ Date _____

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:
   1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 15 business days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail," or forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail," or form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Owner may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven business days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
   4. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 01 10 00 "Summary."

B. Format and Content: Use Project Manual 00 11 10 “Table Of Contents” as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
7. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
    1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
    2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
    3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
    4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
    1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
    2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials indicating the following:
   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien on Owner-designated forms.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
2. Confirm with Owner if digital copies may be submitted in lieu of original hard copies.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from entities lawfully entitled to file a mechanic’s lien arising out of the Contract and related to the Work covered by the payment.
1. Submit signed copy of “Conditional Waiver and Release upon Progress Payment” form on each item for amount requested in current application for payment.
2. Submit signed copy of “Unconditional Waiver and Release upon Progress Payment” form for amount requested in previous application for payment, after deduction for retainage, on each item.
3. When an application shows completion of an item, submit signed copy of “Condition Waiver and Release Upon Final Payment” form for the amount invoiced. Upon receipt of payment, submit signed copy of “Unconditional Waiver and Release upon Final Payment” form.
4. Owner reserves the right to designate which entities involved in the Work must submit waivers.
5. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
6. Waiver Forms: Submit executed waivers of lien on forms, provided by or acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Requests for Information (RFIs).
   4. Project Web site.
   5. Project meetings.

B. Related Requirements:
   1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A, or include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 calendar days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      e. Indicate required installation sequences.

f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Autodesk Revit, Latest Version, operating in Microsoft Windows operating system..
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

b. Digital Data Software Program: Drawings are available in Autodesk Revit, Latest Version.
c. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow ten business days for Architect's response for each RFI. RFIs received by Architect after 3:00 p.m. Central Standard Time (CST) will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case additional response time may be required. Architect will notify Owner and Contractor when additional response time is reasonably necessary due to information needed from other parties or die to the particular nature of the RFI, for approval by Owner.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 business days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project software with not less than the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven business days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Autodesk Revit, Latest Version.
4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual or Agreement form acceptable to Owner and Architect.
    a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement included in this Project Manual or Agreement acceptable to Owner and Architect.

B. Web-Based Project Software: Use a web-based Project software site mutually acceptable to Owner and Architect, for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project software site includes, at a minimum, the following features:
    a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.

d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of contract modifications.
h. Creating and distributing meeting minutes.
i. Document management for Drawings, Specifications, and coordination drawings, including revision control.
j. Management of construction progress photographs.
k. Mobile device compatibility, including smartphones and tablets.

2. Provide up to ten web-based Project software user licenses for use of Owner, Construction Manager, Architect, and Architect's consultants. Provide webinar software training for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT WEB SITE

A. Provide, administer, and use Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Photo documentation.
8. Schedule and calendar management.
9. Submittals forms and logs.
10. Payment application forms.
11. Drawing and specification document hosting, viewing, and updating.
12. Online document collaboration.
13. Reminder and tracking functions.
14. Archiving functions.
15. Tasking features.

B. Provide up to ten Project Web site user licenses for use of the Owner, Architect, and Architect's consultants. Provide webinar training for Project Web site users.

C. On completion of Project, provide one complete archive copy(ies) of Project Web site files to Owner and to Architect in a digital storage format acceptable to Architect.

D. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.9 PROJECT MEETINGS

A. General: Contractor will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three business days of the meeting.

B. Preconstruction Conference: Contractor will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 business days after execution of the Agreement.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Responsibilities and personnel assignments.
      b. Tentative construction schedule.
      c. Phasing.
      d. Critical work sequencing and long-lead items.
      e. Designation of key personnel and their duties.
      f. Lines of communications.
      g. Use of web-based Project software.
      h. Procedures for processing field decisions and Change Orders.
      i. Procedures for RFIs.
      j. Procedures for testing and inspecting.
      k. Procedures for processing Applications for Payment.
      l. Distribution of the Contract Documents.
      m. Submittal procedures.
      n. Preparation of record documents.
      o. Use of the premises.
      p. Work restrictions.
      q. Working hours.
      r. Owner's occupancy requirements.
      s. Responsibility for temporary facilities and controls.
      t. Procedures for moisture and mold control.
      u. Procedures for disruptions and shutdowns.
      v. Construction waste management and recycling.
      w. Parking availability.
      x. Office, work, and storage areas.
      y. Equipment deliveries and priorities.
      z. First aid.
      aa. Security.
      bb. Progress cleaning.
   4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility requirements.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written instructions.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Contractor will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 business days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of record documents.
      b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Contractor will conduct progress meetings at regular intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether critical activities are on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of BIM coordination efforts, and critical component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of proposal requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Contractor will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site utilization.
        9) Temporary facilities and controls.
        10) Work hours.
        11) Hazards and risks.
        12) Progress cleaning.
        13) Quality and work standards.
        14) Status of RFIs.
        15) Proposal Requests.
        16) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Electronic Data Transfer Agreement

This Agreement is entered into and agreed by, between and among Populous and its consultants on the project (Populous), _____ ***(name of Owner)*** (Owner) and _____ ***(name of, Contractor, Construction Manager, Subcontractor or Vendor, as applicable)*** (Recipient(s)) and is made in reference to the _____ (the Project).

In consideration of the request of _____ ***(name of Owner, Contractor, Construction Manager, Subcontractor or Vendor)*** to Populous to deliver to Recipient(s) certain Electronic Data for use on the Project, the parties mutually agree as follows:

Electronic Data includes but is not limited to, Digital Model Files, 3D building model (Revit) files, computer-aided design (CAD) files including native file formats (DWG) and drawing exchange formats (DXF), files. The Electronic Data is being provided in its original format produced by Populous. The specific Electronic Data and formats to be transferred are as follows:

(List if stand-alone document; not required if under the terms of an agreement that covers distribution of electronic media in general.)

The means by which the Electronic Data is transferred may include but are not limited to, electronic mail, File Transfer Protocol (FTP) sites and disc copies transmitted between the parties in this Agreement. Owner and Recipient(s) acknowledge that Electronic Data transferred in any manner or translated from the system and format used by Populous to an alternate system or format is subject to errors that may affect the accuracy and reliability of the data and that the data may be altered, whether inadvertently or otherwise. **ACCORDINGLY, POPULOUS MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY OF THE INFORMATION TRANSFERRED. THE ELECTRONIC DATA ARE NOT THE CONSTRUCTION DOCUMENTS AND DIFFERENCES MAY EXIST BETWEEN THESE ELECTRONIC FILES AND CORRESPONDING HARD-COPY CONSTRUCTION DOCUMENTS AND ACTUAL CONSTRUCTION. RECIPIENT UNDERSTANDS AND ACKNOWLEDGES THE INFORMATION PROVIDED IS FOR REFERENCE ONLY, AND RECIPIENT WILL VERIFY THE DRAWINGS WITH EXISTING SITE CONDITIONS. POPULOUS RESERVES THE RIGHT TO RETAIN HARD COPY ORIGINALS IN ADDITION TO ELECTRONIC COPIES OF THE ELECTRONIC DATA TRANSFERRED, WHICH ORIGINALS SHALL BE REFERRED TO AND SHALL GOVERN.**

As consideration to Populous for the transfer of the Electronic Data, Owner and Recipient(s) agree that Populous shall not be liable for and hereby waive all claims and agree to indemnify and hold Populous harmless from all liabilities, losses, damages or expenses (including attorneys' fees) arising out of, or connected with: (1) the transfer of Electronic Data by any means; or (2) the use, modification or misuse by parties other than Populous of the Electronic Data; or (3) the limited life expectancy and decline of accuracy or readability of the Electronic Data due to storage; (4) any use of the Electronic Data by any third parties receiving the data from other parties to this Agreement; or (5) the incompatibility of software or hardware used by Populous and the other parties to this Agreement; or (6) viruses.

The Electronic Data provided by Populous under the terms of this Agreement are the proprietary information of Populous or the Owner. Accordingly, Recipient shall not use the Electronic Data for any purpose other than as a convenience in progressing the Work or in the preparation of shop drawings or other required submittals for the Project. All Electronic Data is to be treated as confidential and is not to be disclosed to or shared with others without Populous' express, written consent.

Populous shall be compensated by_____ ***(name of Owner, Consultant, Contractor, Construction Manager, Subcontractor or Vendor, as applicable)*** and upon receipt of payment in full shall transmit the Electronic Data to the appropriate parties in this Agreement. Compensation shall be a Lump-Sum Fee of _____ Dollars ($_____) for the transfer of Electronic Data. Reimbursable Expenses shall be paid in full and are in addition to the Lump-Sum Fee. ***(Insert special fee and reimbursable arrangements not covered above)***

The parties have executed this Agreement as of the dates stated below.

OWNER	**POPULOUS**
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____
[RECIPIENT]	**[RECIPIENT]**
Company: _____	Company: _____
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____
[RECIPIENT]	**[RECIPIENT]**
Company: _____	Company: _____
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

(Delete the Signature blocks that do not apply)

POPULOUS

REQUEST FOR INFORMATION

No: _____

PROJECT: CANADIAN COUNTY EXPO CENTER Populous Project Number: 18.4703	**CONTRACTOR:** Phone: Fax:

RFI Transmittal Record	Attn:	Date Sent	Date Received	Date Due
Contractor to CM				
CM to Populous				
Populous to Consultant				
Consultant to Populous				
Populous to CM				
CM to Contractor				

QUESTION:	**Question By:**		
Drawing Reference:		**Specification Reference:**	
RESPONSE:	**By:**	**Firm:**	**Date:**

_____ **RFI can be answered by Contractor's review of Contract Documents.**

_____ **This response is a clarification or an interpretation of the Contract Documents. No change in the Contract Sum or Contract Time is authorized.**

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SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's construction schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Special reports.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
   2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup construction schedule.
   1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Special Reports: Submit at time of unusual event.

1.4 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including work stages, interim milestones, and partial Owner occupancy.
   4. Review delivery dates for Owner-furnished products.
   5. Review schedule for work of Owner's separate contracts.
   6. Review submittal requirements and procedures.
   7. Review time required for review of submittals and resubmittals.
   8. Review requirements for tests and inspections by independent testing and inspecting agencies.
   9. Review time required for Project closeout and Owner startup procedures.
   10. Review and finalize list of construction activities to be included in schedule.

11. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 business days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 business days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
      a. Structural steel components and finishing.
      b. Custom railings.
      c. Aluminum glazing systems.
      d. Insulated glazing units.
      e. Custom flooring and wall finishes.
      f. Pre-engineered metal buildings.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
   4. Startup and Testing Time: Include no fewer than 15 business days for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
   6. Punch List and Final Completion: Include not more than 30 calendar days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

4. Work Restrictions: Show the effect of the following items on the schedule:
    a. Limitations of continued occupancies.
    b. Uninterruptible services.
    c. Partial occupancy before Substantial Completion.
    d. Use of premises restrictions.
    e. Provisions for future construction.
    f. Seasonal variations.
    g. Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.
6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
1. Topping out.
2. Temporary enclosure and space conditioning.
3. Building enclosure, permanent.
4. HVAC start up.
5. Permanent power start up.
6. Testing and Balancing.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 calendar days of date established for commencement of the Work. Outline significant construction activities for the first 90 calendar days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
   1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 calendar days after date established for commencement of the Work.
      a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
   2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
   3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   4. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by Contractor's activities.
      i. Testing.
      j. Punch list and final completion.
      k. Activities occurring following final completion.
   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
   3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions, including presence of rain or snow.
   7. Testing and Inspection.
   8. Accidents.
   9. Meetings and significant decisions.
   10. Unusual events (see special reports).
   11. Stoppages, delays, shortages, and losses.
   12. Meter readings and similar recordings.
   13. Emergency procedures.
   14. Orders and requests of authorities having jurisdiction.
   15. Change Orders received and implemented.
   16. Construction Change Directives received and implemented.
   17. Services connected and disconnected.
   18. Equipment or system tests and startups.
   19. Partial completions and occupancies.
   20. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one business day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
   1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
   2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:
1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 31 01 “Electronic Data Transfer Agreement Form” for data licensing agreement.
4. Section 01 40 00 - Quality Requirements: Manufacturer's field services and reports.
5. Section 01 77 00 - Contract Closeout Procedures: Contract warranty and manufacturer's certificates, specified warranties and closeout submittals.
6. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. By receipt and/or use of Digital Data, the receiving party and their assigns agree that the received electronic data cannot be used as basis for, or in support of mediation, arbitration or any other form of legal claim or dispute.
    c. Digital Drawing Software Program: The Contract Drawings are available in Autodesk Revit, latest version.
    d. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
    e. The following digital data files will by furnished for each appropriate discipline:
        1) Floor plans.
        2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 business days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is required, allow 10 business days for initial review of each submittal.
5. Additional Time Required for High-Volume Submittals: Where total quantity of submittals received in any five (5) consecutive business day periods exceeds 150 sheets, allow for additional 5 business days per each 150 sheets in excess of the initial 150 sheets received for review. Architect will advise Owner and Contractor of additional time required.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single submittal type and transmittal form with links enabling navigation to each item.
2. Name file with submittal number, submittal type abbreviation or unique identifier, including revision identifier.
   a. File name shall use Specification Section number followed by a submittal type abbreviation (listed below), another hyphen, and a sequential number (e.g., 06 10 00-SD-01).
   b. Resubmittals shall include the above submittal number followed by another hyphen and a revision number suffix (e.g., 06 10 00-SD-01-R1).
   c. Submittal Type Abbreviations:

Abbreviation	Submittal Type	Examples
PD	Product Data	
SA	Samples	• Samples for Initial Selection • Samples for Verification
SD	Shop Drawings	
PS	Product Schedule / List	• Door Hardware • Equipment
DD	Delegated-Design Submittal	• Engineered Shop Drawings • Calculations • Mix Design
CD	Coordination Drawings	
QD	Qualification Data	• Statements • Seismic Qualification Certificate
CE	Certificates	• Material/Product Certificate • Welding Certificate • Installer Certificate • Manufacturer Certificate • Oversize Construction Certificate

Abbreviation	Submittal Type	Examples
RE	Reports	• Material Test Reports • Product Test Reports • Preconstruction Test Reports • Research/Evaluation Reports • Source Quality-Control Reports • Field Quality-Control Reports • Compatibility Test Reports • Compatibility and Adhesion Test Report • Field Test Reports • Manufacturer's Field Reports
WA	Warranty	
DE	Design Data	
DI	Diagrams	• Wiring Diagrams

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Contractor.
   e. Name of firm or entity that prepared submittal.
   f. Names of subcontractor, manufacturer, and supplier.
   g. Category and type of submittal.
   h. Submittal purpose and description.
   i. Specification Section number and title.
   j. Specification paragraph number or drawing designation and generic name for each of multiple items.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Related physical samples submitted directly.
   n. Indication of full or partial submittal.
   o. Transmittal number, numbered consecutively.
   p. Submittal and transmittal distribution record.
   q. Other necessary identification.
   r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   2. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   3. Action Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Architect will return two copies.
   4. Informational Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Architect will not return copies.
   5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.

b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
   a. PDF electronic file.
4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
   a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
   b. Refer to Section 01 31 00 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:
    a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Construction Manager and Consultant will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager and Consultant will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
   1. Approved: The Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents.
   2. Approved as Noted: The Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal, and the requirements of the Contract Documents.
   3. Approved as Noted / Resubmit: The Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal, and the requirements of the Contract Documents. Make corrections submittal according to the notations and resubmit for record.
   4. Revise / Resubmit: Do not proceed with Work covered by the submittal. Revise or prepare a new submittal according to the notations. Repeat if necessary to obtain different action mark.
   5. Rejected: Do not proceed with Work covered by the submittal. The Work covered by the submittal does not conform to the Contract Documents. Prepare a new submittal. Repeat if necessary to obtain different action mark.
   6. No Action Taken or Required: For Informational Submittals that are packaged with Action Submittals, and do not require action.
   7. Not Required for Review: Portion of submittal was not required of the Contract Documents, and therefore was not reviewed by Architect.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

POPULOUS

SUBMITTAL TRANSMITTAL

No: _____

PROJECT: CANADIAN COUNTY EXPO CENTER Populous Project Number: 18.4703	**CONTRACTOR:** Phone: Fax:

Transmittal Record	**Attn:**	**Date Sent**	**Date Rec'd**	**Quantity**		
				Prints	**Mfg. Lit.**	**Samples**
Contractor to CM						
CM to Populous						
Populous to Consultant						
Consultant to Populous						
Populous to CM						
CM to Contractor						

Action Taken

A = Approved
AN = Approved as Noted
AN/R = Approved as Noted / Resubmit
RR = Revise and Resubmit
REJ = Rejected
NARR = No Action Taken or Required
NRR = Not Required for Review

A	**AN**	**AN/R**	**RR**	**REJ**	**NARR**	**NRR**	**Spec or Dwg. No.**	**Date**	**Deviations from Contract Docs.**	**Description**

Contractor Remarks:	**Architect Remarks:**

NOTE: Notations do not authorize changes to Contract Sum or Contract Times. Submittal has been reviewed for Architectural design conformity and general conformance to Contract Documents only. Contractor shall confirm and correlate dimensions at Project Site for tolerances, clearances, quantities, fabrication processes, techniques of construction, coordination of Work, and full compliance with Contract Documents. Acceptance of Submittal does not constitute acceptance of undocumented deviations.

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data : For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
   2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.

8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
   1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
   3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.

13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. AABC - Associated Air Balance Council; www.aabc.com.
   2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.

3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.

52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).
71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA - Electronic Components Industry Association; www.eciaonline.org.
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
80. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
81. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
82. FM Approvals - FM Approvals LLC; www.fmglobal.com.
83. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
84. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
85. FSA - Fluid Sealing Association; www.fluidsealing.com.
86. FSC - Forest Stewardship Council U.S.; www.fscus.org.
87. GA - Gypsum Association; www.gypsum.org.
88. GANA - Glass Association of North America; www.glasswebsite.com.
89. GS - Green Seal; www.greenseal.org.
90. HI - Hydraulic Institute; www.pumps.org.
91. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
92. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
93. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
94. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
95. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
96. IAS - International Accreditation Service; www.iasonline.org.
97. IAS - International Approval Services; (See CSA).
98. ICBO - International Conference of Building Officials; (See ICC).
99. ICC - International Code Council; www.iccsafe.org.
100. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
101. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
102. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
103. IEC - International Electrotechnical Commission; www.iec.ch.

104. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
105. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
106. IESNA - Illuminating Engineering Society of North America; (See IES).
107. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
108. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
109. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.
122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.
126. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NBI - New Buildings Institute; www.newbuildings.org.
135. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
136. NCMA - National Concrete Masonry Association; www.ncma.org.
137. NEBB - National Environmental Balancing Bureau; www.nebb.org.
138. NECA - National Electrical Contractors Association; www.necanet.org.
139. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
140. NEMA - National Electrical Manufacturers Association; www.nema.org.
141. NETA - InterNational Electrical Testing Association; www.netaworld.org.
142. NFHS - National Federation of State High School Associations; www.nfhs.org.
143. NFPA - National Fire Protection Association; www.nfpa.org.
144. NFPA - NFPA International; (See NFPA).
145. NFRC - National Fenestration Rating Council; www.nfrc.org.
146. NHLA - National Hardwood Lumber Association; www.nhla.com.
147. NLGA - National Lumber Grades Authority; www.nlga.org.
148. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
149. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
150. NRCA - National Roofing Contractors Association; www.nrca.net.
151. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
152. NSF - NSF International; www.nsf.org.
153. NSPE - National Society of Professional Engineers; www.nspe.org.

154. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
155. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoor.org.
166. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.
171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
172. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
175. SPRI - Single Ply Roofing Industry; www.spri.org.
176. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
179. STI - Steel Tank Institute; www.steeltank.com.
180. SWI - Steel Window Institute; www.steelwindows.com.
181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
182. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
184. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
185. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
186. TMS - The Masonry Society; www.masonrysociety.org.
187. TPI - Truss Plate Institute; www.tpinst.org.
188. TPI - Turfgrass Producers International; www.turfgrasssod.org.
189. UL - Underwriters Laboratories Inc.; www.ul.com.
190. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
191. USGBC - U.S. Green Building Council; www.usgbc.org.
192. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
193. WASTEC - Waste Equipment Technology Association; www.wastec.org.
194. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
195. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
196. WDMA - Window & Door Manufacturers Association; www.wdma.com.
197. WI - Woodwork Institute; www.wicnet.org.
198. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
199. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
   2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   3. ICC - International Code Council; www.iccsafe.org.
   4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
   1. COE - Army Corps of Engineers; www.usace.army.mil.
   2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
   3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
   4. DOD - Department of Defense; www.quicksearch.dla.mil.
   5. DOE - Department of Energy; www.energy.gov.
   6. EPA - Environmental Protection Agency; www.epa.gov.
   7. FAA - Federal Aviation Administration; www.faa.gov.
   8. FG - Federal Government Publications; www.gpo.gov.
   9. GSA - General Services Administration; www.gsa.gov.
   10. HUD - Department of Housing and Urban Development; www.hud.gov.
   11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
   12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
   13. SD - Department of State; www.state.gov.
   14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
   15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
   16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
   17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
   18. USP - U.S. Pharmacopeial Convention; www.usp.org.
   19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
   2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
   3. DSCC - Defense Supply Center Columbus; (See FS).
   4. FED-STD - Federal Standard; (See FS).
   5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
      a. Available from Defense Standardization Program; www.dsp.dla.mil.
      b. Available from General Services Administration; www.gsa.gov.
      c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
   6. MILSPEC - Military Specification and Standards; (See DOD).
   7. USAB - United States Access Board; www.access-board.gov.
   8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
   2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
   3. CDHS; California Department of Health Services; (See CDPH).
   4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
   5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
   6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
   7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 32 50 10 "Hot-Mix Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
3. Section 32 50 15 "Cement Concrete Pavement" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in The Department of Justice 2010 ADA Standards, and IBC and ICC/ANSI A117.1 or other locally enforced accessibility standards.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Meet or exceed the more restrictive of Owner requirements or the following material standards.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company and Owner, for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   1. Install electric power service overhead unless otherwise indicated.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line for each field office.
   1. Provide additional telephone lines for the following:
      a. Provide a dedicated telephone line for each facsimile machine in each field office.
   2. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Contractor's emergency after-hours telephone number.

e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

J. Electronic Communication Service: Provide internet access in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications via their own laptops.
1. .

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 50 10 "Hot-Mix Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2012 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 10 00 for site clearing.

D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 01 23 00 "Alternates" for products selected under an alternate.
   2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
   3. Section 01 42 00 "References" for applicable industry standards for products specified.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," or “or equivalent”, comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 01 10 00 "Summary" for limits on use of Project site.
   2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
   3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   4. Section 07 84 13 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products to be used for patching and firms or entities that will perform patching work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Certified Surveys: Submit two copies signed by land surveyor.

F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
      a. Primary operational systems and equipment.
      b. Fire separation assemblies.
      c. Air or smoke barriers.
      d. Fire-suppression systems.
      e. Mechanical systems piping and ducts.
      f. Plumbing piping systems.
      g. Control systems.
      h. Communication systems.
      i. Fire-detection and -alarm systems.
      j. Electrical wiring systems.
      k. Operating systems of special construction.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
      a. Water, moisture, or vapor barriers.
      b. Membranes and flashings.
      c. Equipment supports.
      d. Piping, ductwork, vessels, and equipment.
      e. Noise- and vibration-control elements and systems.
   4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record 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. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Section 01 73 00 "Execution" for progress cleaning of Project site.
   2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
   1. Schedule of Inspections: When Contractor believes the Work is substantially complete, he shall submit a schedule of inspection delineating area or phases of the Work for which Substantial Completion inspections shall be performed. This schedule shall be submitted to the Architect for review and comment, and to the Owner for approval.
   2. Punch List: Contractor shall perform an inspection and submit a list of incomplete items, prior to Architect’s and Owner’s inspection of substantially complete spaces.

3. Software: Contractor, Architect and Owner shall determine a mutually acceptable software to be utilized for this inspection and report.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Contractor's As-Built Drawings: Submit neatly and clearly marked up contract drawings, prints and other data that describe any relevant changes or deviations from the Contract Documents in the final execution of building elements and systems. Architect shall use Contractor's As-built mark-up set to produce the Record Drawings incorporating applicable addenda, clarifications, and change orders on the project. Any additional changes made after Substantial Completion and prior to Final Completion should also be recorded by Contractor on the As-Built Drawings, and re-transmitted to the Architect prior to submission for Final Completion.
   3. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
   4. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.
      a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
   6. Submit test/adjust/balance records.
   7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Advise Owner of pending insurance changeover requirements.
   2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   3. Complete startup and testing of systems and equipment.
   4. Perform preventive maintenance on equipment used prior to Substantial Completion.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
   6. Advise Owner of changeover in heat and other utilities.
   7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
   8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   9. Complete final cleaning requirements, including touchup painting.
   10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

C. State Required Inspections: Verify the requirements of the State having jurisdiction and comply with their notification procedures.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. MS Excel electronic file. Architect will return annotated file.
      b. PDF electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.

f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.
   2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return the copy.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Architect.
   7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.

8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Section 01 73 00 "Execution" for final property survey.
   2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
   3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
   a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.
   b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.
2. Documentation: Review the following items in detail:
    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.
5. Adjustments: Include the following:
    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, a written, or a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1. Footings
2. Slabs-on-grade

B. Related Requirements:

1. Division 31 Section “Earthwork for drainage fill under slabs-on-grade
2. 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, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference:

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.
    e. Concrete finish 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, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. 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.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. 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. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. 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-1 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.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage

1.9 FIELD CONDITIONS

A. 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.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 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.

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 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.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
3. Overlaid Finnish birch plywood.

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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, 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. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M].

C. Plain-Steel Welded-Wire Reinforcement: ASTM A 185/A 185M, 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 true to length with ends square and free of burrs.

B. Zinc Repair Material: ASTM A 780/A 780M.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," 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.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I.

2. Fly Ash: ASTM C 618, Class F or C.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM 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.

F. Water: ASTM C 94/ and potable.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.9 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.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches (before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size. Apply air content if exterior exposure.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Moisture Vapor Reduction Admixture: ASTM C 494/C 494M, Type S

C. Other Concrete: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Exterior Exposure Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Provide standees between upper and lower mats.

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct 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 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.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

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 303.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that 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/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. 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.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Use a bonding agent 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. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

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 "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.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and approval of the architect.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. 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 not to 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.

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.

3.7 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.

3.8 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. All Exposed Concrete Floors shall be built to a Flatness/Levelness rating of 40/30, respectively.

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 one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

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.

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 to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances unless noted otherwise: 1/8” in 10 ft. in any direction with a straight edge.

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 thinset 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, 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.

3.9 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. 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.

3. Minimum Compressive Strength: 4000 psi at 28 days.

3.10 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 301 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.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods, but do not use absorptive or moisture retaining covers on exposed concrete floors:

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.

3.11 LIQUID FLOOR TREATMENT APPLICATION

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
    1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
    2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
    3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
    4. Control and dispose of waste products produced by grinding and polishing operations.
    5. Neutralize and clean polished floor surfaces.
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.

3.12 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 month. 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 joints clean and dry.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, 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 honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. 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 by blending white portland cement and standard portland cement so that, when dry, patching mortar matches 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.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. 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 spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, 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 fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish 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.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

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.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M 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.
    a. When frequency of testing provides 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.
2. 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.
3. Air Content: ASTM C 231/C 231M, 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.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days and hold one set of two specimens for additional testing at 56 days.

a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

c. Test a set of two field-cured specimens at 56 days if specifically directed by the Architect/Engineer.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

9. 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.

10. 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.

11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

12. Additional Tests: 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.

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

14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000

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SECTION 03 35 43 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes polished concrete finishing, including staining and pattern at locations indicated, on cured concrete slabs.
   1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for concrete not designated as polished concrete.
   2. Section 07 92 00 “Joint Sealants” for control joint product suitable for use in a polished concrete application.

1.2 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

B. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

C. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.

D. Dry Mechanical Polish: Mechanical polishing process that doesn’t use any water and does not create a slurry. Airborne dust particulates are captured with a vacuum system, which will contain 99.6% of airborne dust.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   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 polished concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Cast-in-place concrete subcontractor.
      c. Polished concrete finishing Subcontractor.
   2. Review construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints and joint sealant.

C. Samples for Verification: For each type of exposed color.

D. Shop Drawing: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints and saw cut joints at color changes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:
1. Repair materials.
2. Stain materials.
3. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Mockups: Before polishing concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Demonstrate curing, finishing, and protecting of stained concrete.
3. Demonstrate curing, finishing, and protecting of polished concrete.
4. Manufacturer's representative to determine slip resistance of floor.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Dynamic Coefficient of Friction: For floor, not less than 0.60 per ASTM C1028.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's approved 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.

C. Dispense special concrete finish material from manufacturer's factory numbered and sealed containers. Maintain record of container numbers.

1.8 FIELD CONDITIONS

A. Environmental Controls:
1. Concrete must be cured a minimum of 28 days before polishing activities can start.

B. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting installation performance.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS (SC2)

A. Basis-Of-Design: Subject to compliance with requirements, provide Bomanite Co., Pantene Teres; color and style as indicated on Finish Schedule on the Architectural Drawings; or comparable products by one of the following manufacturers:
   1. Advanced Floor Products.
   2. AmeriPolish, Inc.
   3. L&M Construction Chemicals, Inc.
   4. Scofield, L. M. Company.

B. Source Limitations: Provide all materials from single manufacturer necessary for a complete installation. Do not substitute materials.

C. Concrete Densifiers: Water-based, penetrating lithium densifier.
   1. Water based liquid hardener; Bomanite Stabilizer Pro: Lithium Silicate with Silane additives to chemically harden and improve the density of concrete surfaces.
   2. Water based final liquid hardener; Bomanite Stain Guard: Lithium Silicate and Methacrylate additives to chemically harden and improve the stain resistance of interior concrete surfaces.

D. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.
   1. Water based liquid coloring solution; Bomanite Concrete Dye: Color applied into the pore structure of a ground concrete surface.
      a. Colors to be selected from the full range of Bomanite Concrete Dyes and as approved in the sample process. Refer to Architectural Drawings, Finish Schedule.

E. Class 2: Semi-gloss or medium reflectivity.

F. Related Materials.
   1. Patching materials: Bomanite GFRC Facing Mix. Trowel or spray applied mortar based on Type II Portland cement blended with Calcium Aluminate cement modified with Styrene Butadiene polymer designed to bond to prepared concrete and cure rapidly in order to aid grinding production.
   2. Sealer: Bomanite Clear Cure, water based acrylic sealer designed to meet ASTM C-309 membrane curing standards.
   3. Joint Filler: Hi-Tech Structural Systems Polyurea Joint Filler HT-PE85. Two component rapid curing polyurea joint filler designed to fill and support the sawed joints in a concrete slab.

2.2 POLISHED CONCRETE FLOOR WITH LIQUID FLOOR TREATMENTS (SC1)

A. General: Provide polished concrete floor finishing system using materials and equipment recommended by manufacturer to achieve specified finish as follows:
   1. Polish Type: Dry mechanical polish.
   2. Shine Level: Class 3: High Reflectivity: 1500 grit.
   3. Aggregate Exposure: Grade 2: Light Aggregate Finish. Grind and polish surface to expose a spattering of aggregate in concrete.
   4. Color: As casted concrete.

B. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
   1. Product may not contain potassium silicate or sodium.

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

2. AmeriPolish, Inc.
3. Bomanite Co.
4. L&M Construction Chemicals, Inc.
5. Scofield, L. M. Company (Basis of Design).

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Examine substrate, with installer present, for conditions affecting performance of finish. Rectify conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.

B. Prior to application, verify that floor surfaces are free of construction damage and contaminants.

C. Repair of defective concrete due to improper installation is the Polishing Concrete Contractor's responsibility. Removal and replacement of concrete that cannot be repaired and patched to Architect's approval is the Contractor's responsibility.

D. Application is to take place and be completed prior to furniture and millwork installation.

E. Only a certified applicator shall install manufacturer's material. Applicable procedures must be followed as recommended by the product manufacturer and as required to match approved test sample and achieve required properties.

3.2 PREPARATION

A. Concrete shall be completely cured for a minimum of 28 days before beginning preparation and application of polishing system. Ensure that any chemical curing compounds used in the placement and curing of the concrete have been completely removed.

B. Examine substrate, with installer present, for conditions affecting performance of finish. Rectify conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.
   1. Verify control joints are filled with compatible product and are shaved prior to grinding and polishing.
   2. Verify that floor surfaces are free of construction damage.

C. Comply with manufacturer's instructions for preparation of substrates to receive polishing system.

D. Protect adjacent surfaces and finishes from grinding solutions. Close off floor drains to prevent spillage and migration of materials outside work area.

E. Repair of defective concrete due to improper installation is the Polishing Concrete Contractor's responsibility. Removal and replacement of concrete that cannot be repaired and patched to Architect's approval is the General Contractor's responsibility.

F. Patching: Patch existing concrete prior to grinding and staining. Seed top coat with aggregate in random application to mimic exposed concrete slab. Provide aggregate 'seeds' for 20% of patched area.

G. Control joints: Fill with joint sealant and shaved prior to the grinding and polishing process.

H. Scoring (Where Indicated): Score decorative jointing in concrete surfaces 1/16 inch (1.6 mm) deep with diamond blades to match pattern indicated. Rinse until water is clear. Score before staining.
   1. Joint Width: 1/8 inch (10 mm).

3.3 POLISHING

A. Apply specialty hardening and polishing process in accordance with manufacturer's proprietary application procedures for interior locations.

B. Grind and Polish: Grind concrete to a specified exposure with top size aggregate exposure per approved mockup.
   1. Machine grind floor surfaces to receive polished finishes level and smooth.
   2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
   3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
   4. Control and dispose of waste products produced by grinding and polishing operations.
   5. Neutralize and clean polished floor surfaces.

3.4 STAINING

A. Newly placed concrete shall be at least 30 days old before staining.

B. Prepare surfaces according to manufacturer's written instructions and as follows:
   1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
      a. Do not use acidic solutions to clean surfaces.
   2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding and sanding. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
   3. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.

C. Scoring: Score decorative jointing in concrete surfaces 1/16 inch deep with diamond blades to match pattern indicated. Rinse until water is clear. Score before staining.
   1. Joint Width: 1/4 inch.

D. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

E. Penetrating Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions and as follows:
   1. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
   2. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
   3. Rinse until water is clear. Control, collect, and legally dispose of runoff.

3.5 FINISHING

A. After grinding and polishing activities are completed, treat floor with penetrating finishing product and a high-speed burnisher.

B. Apply two coats prior to burnishing. Burnish floor according to manufacturer's instructions.

C. Determine wet and dry slip resistance after burnishing. Bring floor to approved coefficient of friction.

3.6 CLEANING PROTECTING

A. Clean floor according to manufacturer after allowing floor to dry. Ensure compatibility of floor cleaner to finishing product.
   1. Do not use acid based cleaners.

B. Protect floor during remainder of construction process with kraft paper and 1/8” hardboard for heavily traffic areas. Replace floor protection as they become damaged.

C. Do not allow contractors to mark finished floors with sharpies, spray paint or other materials. Do not leave tape on floor for more than a month. Do not allow mortar or joint compound to dry on floor.

END OF SECTION

SECTION 03 54 16 - HYDRAULIC CEMENT UNDERLAYMENT

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 polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.
   1. Moisture Mitigation of concrete substrates, (if required). Before flooring is installed perform testing as indicated in flooring sections.
   2. Concrete repair system.

B. Related Sections:
   1. Section 03 30 00 “Cast in Place Concrete” for concrete slab information.
   2. Division 9 Sections -for all applied floor finishes
   3. Division 9 Sections -for moisture and PH testing requirements of flooring substrates before underlayment or flooring is installed.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including mix designs, certifications and laboratory test reports.

B. Warranties: Sample of manufacturer’s warranty.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
   1. Installation contractor shall be approved by the manufacturer as a qualified contractor trained in the application of *moisture mitigation* and underlayment/topping systems. Installation contractor shall provide proper documentation from manufacturer of approval of qualifications.
   2. Installation contractor shall oversee and manage all aspects of the *mitigation* and topping process utilizing its own trained forces, subcontracting any portion of the process is disallowed.
   3. Installation contractor shall provide written proof of the successful completion of previous work similar in scope and size to the work scheduled in this section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
   1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.8 WARRANTY

A. Underlayment: Manufacturer's Installer extended manufacturer warranty.
   1. Warranty Period: Ten years from date of Substantial Completion

B. Moisture Mitigation (if required). Extended factory warranty
   1. Fifteen years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 MOISTURE MITIGATION

A. Acceptable Manufacturers:
   1. Ardex Engineered Cements, Inc. Aliquippa, PA.
   2. Uzin Floor Systems, Ufloor Systems, Aurora, CO.
   3. Schonox, HPS North America.

B. Epoxy Mitigation Material:
   1. Two coat system consisting of a Prime Coat and a Seal Coat.
   2. Solvent Free per SCAQMD 1168.
   3. Alkali Resistant.
   4. Appropriate for application to damp concrete.
   5. Permeability 0.1 perms per ASTM E96.
   6. No alkali effect per ASTM D1308.

C. Moisture Mitigation: Moisture mitigation products and underlayment must be by the same manufacturer.
   1. Ardex Engineered Cements: Ardex MC Plus.
   2. Uzin: PE480.
   3. Schonox, EPA.

2.3 HYDRAULIC CEMENT UNDERLAYMENTS

A. Acceptable Manufacturers:
   1. Ardex Engineered Cements, Inc.
      a. Basis of Design.
   2. BASF.
   3. Dayton Superior.
   4. Euclid.
   5. Laticrete.
   6. MAPEI Corporation.
   7. TEC, HB Fuller Construction Products.
   8. Uzin Floor Systems, Ufloor Systems.

B. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150/C 150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
   2. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
   3. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

C. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
   1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

D. Water: Potable and at a temperature of not more than 70 deg F.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

F. Applications:
   1. Underlayment material installed over Moisture Mitigation
      a. Ardex K15.
      b. Schonox.
      c. Uzin: NC 170.
   2. Underlayment mat.erial for renovation areas that do not receive moisture mitigation:
      a. Ardex K 15.
      b. Schonox.
      c. Uzin:
         1) NC 170: self leveling.
         2) NC 888: trowelable.
   3. Trench Filler: Repair material for trenches remaining after partitions are demolished or for repairing deep areas before installing mitigation and underlayment.
      a. Ardex TRM: Transportation Repair Mortar.
   4. Final Patch material: Repair material installed just before flooring is installed to provide final leveling:
      a. Ardex Forti Finish.
      b. Schonox, SL.

2.4 REPAIR MORTAR

A. Formable, pourable, pumpable, Portland cement-based, microsilica-modified, structural repair mortar. Add graded aggregate as recommended by repair mortar manufacturer for installations over 4 inches deep.
   1. Ardex TRM.

B. Performance and Physical Properties: Meet or exceed the following values for material cured at 73° F and 50 percent relative humidity.
   1. Compressive Strength (ASTM C109): 2 hours 3500 psi 245.0 kg/cm2, 3 hours 4500 psi 315.0 kg/cm2 , 1 day 5750 psi 402.5 kg/cm2 , 7 days 7500 psi 525.0 kg/cm2 , 28 days 11500 psi 805.0 kg/cm2.
   2. Flexural Strength (ASTM C78): 7 days 850 psi 59.5 kg/cm2, 28 days 1100 psi 77.0 kg/cm2.
   3. Splitting Tensile Strength (ASTM C496): 7 days 550 psi 38.5 kg/cm2, 28 days 625 psi 43.75 kg/cm2.
   4. Modulus of Elasticity: 28 days 3.8 x 106 psi 2.7 x 105 kg/cm2.
   5. Direct Tensile Bond Strength (ASTM D4541): 28 days 240 psi 16.8 kg/cm2.

6. Slant Shear Bond Strength (ASTM C882): 1 day 1250 psi 87.5 kg/cm2, 7 days 2000 psi 140.0 kg/cm2.
7. Mortar (Max Scaled Material): 25 cycles 0.008 psf 0.000004 kg/cm2, 50 cycles 0.01 psf 0.000005 kg/cm2.
8. Time of Setting (ASTM C191): Initial Set 10 min.
9. Final Set 15 min. j. Length Change (ASTM C157, 28 days): In Water -0.002%, In Air -0.05%.
10. Scaling Resistance / Visual Rating (ASTM C672): 25 cycles 1, 50 cycles 1 l. Pot Life / Working Time: 10 - 20 minutes.
11. Time to Traffic: Foot - 2 hours.
12. Full, Including Rolling Loads - 6 hours.
13. Coat or Seal: Approx. 6 hours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.
   1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
   2. Moving joints: All moving joints and cracks must be honored up through the moisture control system, underlayment and floor covering by installing a flexible sealing compound designed specifically for use over moving joints.
   3. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Roughen concrete substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
         1) CSP-3 minimum or as needed to ensure adequate absorption and intimate bond with the concrete substrate.
      b. Comply with ASTM D4258 and ASTM D4259 requirements unless manufacturer's written instructions are more stringent.
   2. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
   3. Moisture Testing: Perform tests indicated below for all areas to receive hydraulic cement underlayment.
      a. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 85 percent relative-humidity-level measurement.
         1) Perform tests so that each test area does not exceed 1,000 sq. ft., and perform not less than two tests in each installation area and with test areas evenly spaced in installation areas.
            a) For interior spaces, perform test in each enclosed, conditioned room at a minimum. Add additional test locations in rooms over 1,000 sq. ft.
         2) Record testing locations on floor plans.

3) Report test results by floor location to Contractor and Architect.
a) Report any location over 97% RH immediately to manufacturer's technical representative on site. Do not apply moisture mitigation materials until approved by Architect and the technical representative.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
   a. Perform testing for pH per ASTM 4262 Test:
      1) Perform tests so that each test area does not exceed 1,000 sq. ft., and perform not less than two tests in each installation area and with test areas evenly spaced in installation areas.
      2) Record testing locations on floor plans.
      3) Report test results by floor location to Contractor and Architect.
5. Slab absorption Testing: Verify that concrete substrates by wetting slab.
   a. Perform testing per ASTM F21, Standard Test Method for Hydrophobic Surface Films by Atomizer Test.
      1) Perform tests so that each test area does not exceed 1,000 sq. ft., and perform not less than two tests in each installation area and with test areas evenly spaced in installation areas.
      2) Record testing locations on floor plans.
      3) Report test results by floor location to Contractor and Architect.

C. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. If it is determined through moisture testing that slab need to be mitigated, apply moisture mitigation with sand broadcast to substrates according to manufacturer's written instructions.

B. General: Mix and apply underlayment components according to manufacturer's written instructions.
   1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
   2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
   3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

C. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

D. Apply underlayment to produce uniform, level surface.
   1. Apply a final layer without aggregate to product surface.
   2. Feather edges to match adjacent floor elevations.

E. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

F. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

G. Apply surface sealer at rate recommended by manufacturer.

H. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 REPAIR MORTAR

A. Preparation
1. General: Prepare substrate in accordance with manufacturer's instructions. Prior to proceeding with any repair, please refer to the International Concrete Repair Institute's Guides and the American Concrete Institute's ACI 546R-04 Concrete Repair Guide for general guidelines for concrete repair.
   a. All concrete and masonry substrates must be sound, solid, dry, and completely free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker. Weak concrete surfaces must also be cleaned down to sound, solid concrete by mechanical methods such as scarifying, scabbling or similar in accordance with ICRI 03732 before priming. Acid etching and the use of sweeping compounds and solvents are not acceptable.
   b. The repair area must be saw cut in a basic rectangular shape at least 1/2" in depth. The cuts should be made at 90° angle, and should be slightly keyed. Chip out the concrete inside the cuts to a minimum depth of 1/2" (12 mm) until the area is squared or box shape.
   c. Mechanically prepare surface to obtain an exposed aggregate surface with a minimum surface profile of approximately 1/16" (1.5 mm).
   d. For cases with exposed reinforcing steel, mechanically clean the steel to remove all rust and any other contaminants in accordance with ICRI 03730. Prime the steel with an anti-corrosion agent prior to proceeding with repair.

B. Joint Preparation:
1. Honor all expansion and isolation joints up through the repair mortar. A flexible sealing compound suitable for the application may be installed.
2. Control Joints and dormant cracks greater than 1/16" – fill all non-moving joints and cracks with elastomeric joint sealant with properties recommended by manufacturer.

C. Installation:
1. Where slabs on grade are completely cut out, patch vapor barrier with new vapor barrier and sealing completely with tape. Install reinforcement at direction of structural engineer.
2. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.
3. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas and landscaping from contact due to mixing and handling of materials.
4. Mixing: Comply with manufacturer's printed instructions and the following:
   a. Precondition components to temperature of 70° plus or minus 5° F (21° plus or minus 2.5° C) prior to mixing.
   b. Mix to a uniform, lump-free consistency. Do not overwater.
   c. For application depths greater than 4 inches, add clean, uniformly graded, dry, 3/8-inch aggregate as directed by manufacturer.
5. Application: Comply with manufacturer's printed instructions and the following.
   a. Primer: Dampen substrate with water and apply primer following manufacturer's recommendation.
   b. When overlaying, Apply scrub coat of repair mortar into primed or saturated surface dry substrate to ensure intimate contact and establish bond.
   c. Steel trowel the repair mortar to the desired finish once it takes its initial set.
   d. Vibrate closed–form repairs to ensure intimate contact with the substrate, establish bond, and ensure proper consolidation. Avoid over-vibration.
   e. Repair mortar can be installed to a minimum thickness of ½" up to 4" neat. For application depths greater than 4", including full depth rep
6. Curing:
   a. Keep surface damp for 48 hours with continuous light water-fogging or curing blanket.

b. If no coating or sealer is to be applied, a water-based curing compound meeting ASTM C309 may be used. Do not use solvent-based curing compounds.
c. Allow to cure a minimum 6 hours before applying any final coatings or sealers.
d. Follow manufacturer's guidance for when foot traffic is allowed.

7. Cleaning: Remove excess material before material cures. If material has cured, remove using mechanical methods that will not damage substrate.

3.5 FINISHED SURFACES

A. Completed underlayment to be uniform in texture and finish. Repair any surface defects in underlayment

B. Finished surfaces to have a maximum slope of 3/16" in ten feet (10') and a maximum slope of 1/32" in one foot (1'- 0").

C. Repair underlayment surface as required just before installing finish flooring.

3.6 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

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SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Heavy-duty interlocking concrete block units.
4. Face brick.
5. Mortar and grout.
6. Steel reinforcing bars.
7. Masonry joint reinforcement.
8. Ties and anchors.
9. Embedded flashing.
10. Miscellaneous masonry accessories.
11. Masonry-cell insulation.

B. Related Sections:
1. Section 05 12 00 "Structural Steel" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 05 50 00 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
3. Section 07 19 00 "Water Repellents" for water repellents applied to unit masonry.
4. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
5. Section 08 95 16 "Wall Vents" for wall vents (brick vents).
6. Section 32 14 00 "Unit Paving" for exterior unit masonry paving.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days as indicated on Structural Drawings (General Notes).
1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
4. Shop drawings showing control and expansion joint locations, reinforcing, and detailing.

C. Samples for Verification: For each type and color of the following:
1. Exposed and decorative CMUs.
2. Heavy-duty interlocking concrete block units.
3. Face brick, in the form of straps of five or more bricks.
4. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
5. Weep holes and vents.
6. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:
1. Masonry units.
   a. Include data on material properties and material test reports substantiating compliance with requirements.
   b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Mill Certificates: Steel producer’s certificates of mill analysis, tensile and bend test for reinforcing steel required for project.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Mortar mix proportions for type of mortar required to achieve specified compressive strength of masonry.
2. Mix designs and mortar tests performed in accordance with ASTM C 270.
3. Grout mix proportions according to ASTM C476 for the types of grout required for the work.
4. Mix designs and grout tests performed in accordance with ASTM C 476.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

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.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.
   1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.
   2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
   3. Protect approved sample panels from the elements with weather-resistant membrane.
   4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
   5. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
   6. Demolish and remove sample panels when directed.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers 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.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 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 inches down both sides of walls and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
   1. When ambient temperature exceeds 100 degrees F, or 90 degrees F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 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.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for outside corners and at door openings and other rectangular wall penetrations unless otherwise indicated.

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.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) ACM Chemistries; RainBloc.
         2) BASF Aktiengesellschaft; Rheopel Plus.
         3) Grace Construction Products; Dry-Block.

C. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on Structural Drawings (General Notes).
   2. Density Classification: Normal weight unless otherwise indicated.
   3. Sizes: (Actual Dimensions): 7-5/8 inches (194 mm) high by 15-5/8 inches (397 mm) long by the following widths:
      a. 4 inch CMU: 3-5/8 inches.
      b. 8 inch CMU: 7-5/8 inches (194 mm)
      c. 12 inch CMU: 11-5/8 inches (295 mm)
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative CMUs: ASTM C 90.
   1. Products: Subject to compliance with requirements, provide the following, or comparable products by other equivalent manufacturers that are similar in color and finish:
      a. Dolese Bros. Co., Camargo Gold split face block.
   2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
   3. Density Classification: Medium weight, 105 to 125 lb/cu. ft. (1682 to 2002 kg/cu. m).
   4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
   5. Pattern and Texture:
      a. Standard pattern, split-face finish. Match Architect's samples.
   6. Colors: Camargo Gold as indicated by manufacturer's designations, or comparable products by other equivalent manufacturers, subject to review and approval by Architect.

E. Heavy-Duty Interlocking Concrete Block Units.
   1. Products: Subject to compliance with requirements, provide Inter-Block Retraining Systems, Inc., Enviro-Block, size (nominal) 59 inches wide by 29.5 inches deep by 29.5 inches high; or one of the following or comparable products by other equivalent manufacturers:
      a. Best Concrete Blocks, Pretty Boy Concrete Block; size (nominal) 60 inches wide by 18 inches deep by 24 inches high.
      b. Modern Concrete, Bin Block; size (nominal) 72 inches wide by 24 inches deep by 24 inches high.
   2. Density Classification: Heavy weight.

3. Pattern and Texture:
   a. Textured or smooth finish as selected by Architect. Provide custom patterns where indicated on the Architectural Drawings.
4. Blocks used as top row shall be flat on the top surface, without any protrusions or exposed lifting anchors.
5. At least one face of each block unit shall be without large blemishes, and exposed to view as outside face of overall wall.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.
   1. Products: Subject to compliance with requirements, provide the following, or comparable products by other equivalent manufacturers that are similar in color and finish:
      a. Acme Brick, Merchant’s Mill BL-10, modular-sized brick.
   2. Grade: SW.
   3. Type: FBS.
   4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of minimum 8250 psi.
   5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
   6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
   8. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Davis Colors; True Tone Mortar Colors.
      b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
      c. Solomon Colors, Inc.; SGS Mortar Colors.

E. Aggregate for Mortar: ASTM C 144.
   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 inch 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.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, 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.

H. 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, 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.

I. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Stainless steel.
   3. Wire Size for Side Rods: 0.187-inch diameter.
   4. Wire Size for Cross Rods: 0.148-inch diameter.
   5. Wire Size for Veneer Ties: 0.148-inch diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
   1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches wide, plus 1 side rod at each wythe of masonry 4 inches wide or less.

2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch-diameter, stainless-steel continuous wire.

2.7 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. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long 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 inches.
3. Wire: Fabricate from 1/4-inch- diameter, stainless-steel wire.

D. 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-inch-diameter, stainless-steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, stainless-steel wire.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, stainless-steel wire.

F. Partition Top anchors: Refer to Structural Drawings for typical masonry details.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

H. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.078-inch-thick, stainless-steel sheet.

3. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.25-inch-diameter, stainless-steel wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
5. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Hohmann & Barnard, HB-213
        2) Wire-Bond; RJ-711.
    b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
6. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Hohmann & Barnard, Inc.; DW-10.
    b. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 9 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 5-1/2 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
7. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 210 with D/A 700-708.
        2) Heckmann Building Products Inc.; 315-D with 316.
        3) Hohmann & Barnard, Inc.; DW-10HS.
        4) Wire-Bond; 1004, Type III.
    b. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
8. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Hohmann & Barnard, Inc.; DW-10-X.
    b. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
9. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Heckmann Building Products Inc.; Pos-I-Tie.
        2) Hohmann & Barnard; Thermal 2-Seal Tie.
        3) Wire-Bond; SureTie WS.

b. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing.

10. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Hohmann & Barnard, Inc.; AA308.
    b. Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch, hot-dip galvanized wire.
11. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213S.
        2) Hohmann & Barnard, Inc.; Seismic Plate Pintle HB-213S with HB-213.
    b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical leg of connector section.
    c. Connector Section: Rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
12. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Wire-Bond; RJ-711 with Wire-Bond clip.
    b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches into veneer but with at least 5/8-inch cover on outside face.
    c. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.
13. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Hohmann & Barnard, Inc.; DW-10-X-Seismiclip.
    b. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.

c. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
d. Fabricate wire connector sections from 0.25-inch- diameter, stainless-steel wire.

14. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) ITW Buildex; Teks Maxiseal with Climaseal finish.
        2) Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.
15. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
        2) ITW Buildex; Scots long life Teks.

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped 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.

B. Postinstalled 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.

2.9 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:
    1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
        a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
            1) Advanced Building Products Inc.; Peel-N-Seal.
            2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
            3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
            4) Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
            5) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
            6) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.

7) Hohmann & Barnard, Inc.; Textroflash.
8) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
9) Polyguard Products, Inc.; Polyguard 300.
10) Sandell Manufacturing Co., Inc.; Sando-Seal.
11) Williams Products, Inc.; Everlastic MF-40..

b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

B. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
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. Mortar Net USA, Ltd.; Blok-Flash.

D. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, 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. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Blok-Lok Limited; Cell-Vent.
3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
4) Heckmann Building Products Inc.; No. 85 Cell Vent.
5) Hohmann & Barnard, Inc.; Quadro-Vent.
6) Wire-Bond; Cell Vent.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Mortar Net USA, Ltd.; Mortar Net.
   2. Provide one of the following configurations:
      a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

E. 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-inch 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..

2.11 MASONRY-CELL INSULATION

A. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
   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. Concrete Block Insulating Systems; Korfil.
      b. Shelter Enterprises Inc.; Omni Core.

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc..

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime mortar.
   4. For reinforced masonry, use portland cement-lime mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type N.
   3. For mortar parge coats, use Type S or Type N.
   4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
   5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Mix to match Architect's sample.
   3. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Face brick.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
      a. Face brick.

F. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
   3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match 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. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than ¼ inch in 10 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, ¼ inch in 20 feet, or 1/2 inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼ inch in 10 feet, or 1/2 inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. 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.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. 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.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. 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. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 46 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow 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.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 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 36 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
      a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
      b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
   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 or tab-type reinforcement.
      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.
      c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
   3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 8 inches clear horizontally and 16 inches clear vertically.
   4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. 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.

D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.

E. Apply air barrier to face of backup wythe to comply with Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

3.7 MASONRY-CELL INSULATION

A. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
   1. Fasten seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
   6. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Locate joints according to approved Shop Drawings.
   1. Place control joints according to National Concrete Masonry Association TEK 10 “Crack Control in Concrete Masonry Walls”, Table 4.

C. Form control joints in concrete masonry as follows:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

D. Form expansion joints in brick as follows:
   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.

2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

E. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
6. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
   3. Space weep holes 24 inches o.c. unless otherwise indicated.
   4. Space weep holes formed from plastic tubing 16 inches o.c.
   5. Trim wicking material flush with outside face of wall after mortar has set.

F. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.
   1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches above top of pea gravel.

G. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

H. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
   1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
   6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 21 13.23 – ADHERED BRICK VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thin brick veneer systems adhered to cement backer board, over sheathing and metal stud framing.

B. Related Sections:
   1. Section 04 20 00 “Unit Masonry” for exterior brick veneer.
   2. Section 05 40 00 "Cold-Formed Metal Framing" for interior load-bearing wall studs.
   3. Section 06 16 00 "Sheathing" for wall sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For veneer, accessories, and manufactured products.

B. Samples for Initial Selection: For colored pointing mortar and other items involving color selection.

C. Samples for Verification:
   1. For veneer indicated. Include at least four Samples in each set and show the full range of color and other visual characteristics in completed Work.
   2. For each color of mortar required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For mortar manufacturer's special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in installing adhered veneer assemblies similar in material, design, and extent to that indicated for this Project, whose work has a record of successful in-service performance.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockups for each type of veneer in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. 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, in a dry location, or in covered weatherproof dispensing silos.

1.7 FIELD CONDITIONS

A. Stain Prevention: Immediately remove mortar and soil to prevent them from staining veneer face.
   1. Protect base of walls from mortar splatter using coverings spread over the 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.

B. 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 veneer units damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.8 COORDINATION

A. Advise installers of other work about specific requirements for placement of items to be built into veneer assembly.

1.9 WARRANTY

A. Special Warranty: Mortar manufacturer's standard form in which manufacturer agrees to repair or replace components of adhered veneer that fail in materials, workmanship, or adhesion within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 THIN BRICK (SP2)

A. Thin Brick: ASTM C 1088 Type TBX; thickness not less than 1/2 inch or more than 1 inch thick, and as follows:
   1. Dimensional Tolerances: Plus 0 inch or minus 1/16 inch for any dimension 8 inches or less and plus 0 inch or minus 3/32 inch for any dimension more than 8 inches.
   2. Out-of-Square Tolerance: Plus or minus 1/16 inch.
   3. Warpage Tolerance: Plus 0 inch or minus 1/16 inch.
   4. Variation of Shape from Specified Angle: Plus or minus one degree.
   5. Modulus of Rupture: Not less than 250 psi when tested according to ASTM C 67.
   6. Tensile Bond Strength: Not less than 150 psi when tested before and after freeze-thaw test according to ASTM E 488 as modified. Adhere a steel plate with a welded rod on a single thin-brick face with epoxy for each test.
   7. 24-Hour Cold-Water Absorption: Not more than 6 percent when tested according to ASTM C 67.
   8. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 freezing-and-thawing cycles when tested according to ASTM C 666/C 666M, Method B.
   9. Chemical Resistance: Tested according to ASTM C 650 and rated "not affected."
   10. Efflorescence: Tested according to ASTM C 67 and rated "not effloresced."

11. Surface Coating: Thin brick with colors or textures applied as coatings shall withstand 50 cycles of freezing and thawing; ASTM C 67 with no observable difference in applied finish when viewed from 10 feet.
12. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.

B. Special Shapes: Include corners, edge corners, and end edge corners.

C. Face Size: 2-1/4 inches high by 7-5/8 inches long.

D. Provide thin brick matching color, texture, and face size of exterior brick work.
1. Acme Brick, Merchant's Mill BL-10, modular-sized brick, or comparable products by other equivalent manufacturers that are similar in color and finish.
2. Refer to Section 04 20 00 "Unit Masonry" for exterior brick veneer.

2.2 CEMENT BACKER BOARD

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, with glass-fiber-reinforced fronts, backs, and long edges, and approved by mortar manufacturer.
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. National Gypsum; PermaBase Brand Cement Board.
2. Thickness: 1/2 inch.

2.3 MORTAR AND WATERPROOFING MATERIALS

A. Source Limitations for Mortar Materials: Obtain mortar system components from a single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Laticrete International, Inc.
2. MAPEI Corporation.
3. Parex USA, Inc.; Merkrete SBVS Systems.

C. Veneer Mortar: Polymer-modified portland cement mortar recommended by the mortar manufacturer for the application indicated.
1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

D. Pointing Mortar: Provide mortar manufacturer's recommended masonry pointing mortar in color selected by Architect from manufacturer's standard.

E. Water: Potable.

2.4 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride.
2. Use portland cement-lime mortar unless otherwise indicated.

3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.

C. Pigmented Mortar: Use colored cement product.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive adhered veneer, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of adhered veneer.

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

3.2 INSTALLATION OF ADHERED MASONRY VENEER

A. Comply with mortar manufacturer’s written instructions, for adhered veneer system specified.

B. Coat backs of units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of units as they are set. Tap units into place, completely filling space between units and scratch coat.

C. Rake out joints for pointing with mortar to depth of not less than 3/4 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.3 POINTING

A. Prepare joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.

B. Point joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
1. Joint Profile: Concave.

3.4 ADJUSTING AND CLEANING

A. Remove and replace veneer units of the following description:
1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Units not matching approved samples and mockups.
4. Units not complying with other requirements indicated.

B. Replace in a manner that results in assembly matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean veneer as work progresses. Remove mortar fins and smears before tooling joints.

END OF SECTION

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SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast stone trim including the following:
      a. Window sills.
      b. Water tables.
      c. Pilaster caps.

B. Related Sections:
   1. Section 04 20 00 "Unit Masonry" for installing cast stone units in unit masonry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
   1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Verification:
   1. For each color and texture of cast stone required, 10 inches square in size.
   2. For each trim shape required, 10 inches in length.
   3. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.

D. Full-Size Samples: For each color, texture, and shape of cast stone unit required.
   1. Make available for Architect's review at Project site or at manufacturing plant, if acceptable to Architect.
   2. Make Samples from materials to be used for units used on Project.
   3. Approved Samples may be installed in the Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.
   1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.
   1. Provide test reports based on testing within previous two years.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical wall area as shown on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone to avoid delaying the Work.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.
   1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
   2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364.

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.
   1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
   2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
   3. Air-Entraining Admixture: ASTM C 260.
   4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
   6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.
   1. Epoxy Coating: ASTM A 775/A 775M.
   2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364.
   1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
   1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
   2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
   3. Provide drips on projecting elements unless otherwise indicated.

C. Fabrication Tolerances:
   1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
   2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
   3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
   4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

D. Cure units as follows:
   1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
   2. Keep units damp and continue curing to comply with one of the following:
      a. No fewer than five days at mean daily temperature of 70 deg F or above.
      b. No fewer than six days at mean daily temperature of 60 deg F or above.
      c. No fewer than seven days at mean daily temperature of 50 deg F or above.
      d. No fewer than eight days at mean daily temperature of 45 deg F or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: Match Architect's samples As selected by Architect from manufacturer's full range.

2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 04 20 00 "Unit Masonry."

2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B. Dowels: 1/2-inch-diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.5 MORTAR MIXES

A. Comply with requirements in Section 04 20 00 "Unit Masonry" for mortar mixes.

2.6 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.
   1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 04 20 00 "Unit Masonry."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
   1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
   2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

C. Fill anchor holes with sealant.
   1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
   1. Form open joint of width indicated, but not less than 3/8 inch.

F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.
   1. Remove mortar fins and smears before tooling joints.
   2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
   3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
3. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 09 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand LRFD 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," Thirteenth Edition.
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. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

5. Submit shop drawings and erection drawings for structural steel work. Contract drawings shall not be copied for use as shop or erection drawings. Drawing size, once established, shall remain consistent throughout submittals. Manufacturing, fabricating or performing of any work prior to the Architect-Engineer's review and approval of shop drawings shall be entirely at the risk of the Contractor.

6. Shop drawings shall include information necessary for the fabrication and erection of the component parts of the structure. They shall indicate size and weight of members, cambers, holes and location of shop and field connections, the type, size and extent of welds, and the welding sequence when required. Welding symbols used on the shop drawings shall be as adopted by the American Welding Society. The proposed shop primer shall be indicated on the shop drawings. Detailing shall be in accordance with AISC "Steel Construction Manual" and "Detailing for Steel Construction".

7. In general, the contract drawings are drawn to scale, but scale measurements shall not be used in locating or arranging members. The fabricator shall check the contract drawings and obtain field measurements of existing conditions before proceeding with detailing and report errors or inconsistencies discovered therein to the Architect-Engineer before starting shop drawings.

8. Corrections or comments made on the shop drawings during the Architect-Engineer's review do not relieve the Contractor from compliance with requirements of the contract drawings and specifications. The review is only for general conformance with the design concept of the project and with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating quantities and dimensions; coordinating his work with that of other trades; and performing his work in a safe and satisfactory manner.

9. Revisions shown on the shop drawings shall be considered as changes necessary to meet specified requirements as shown on Contract Documents and shall not be taken as the basis of claims for extra work.

10. Erection drawings shall describe necessary temporary supports and connections, including the sequence of installation and removal of temporary supports.

11. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

C. Design of Connections: The fabricator shall design connections, including splice connections, in compliance with the drawings, specifications, codes and authorities having jurisdiction. The fabricator shall retain a designer meeting the qualifications of Paragraph 1.5.C, who shall design connections. As evidence of compliance with these requirements, submit connection drawings and calculations bearing appropriate professional sealed certification that the Designer has met the Quality Assurance requirements in Paragraph 1.5.C. Design Criteria and method of analysis shall be subject to approval by the Architect-Engineer prior to final design of connections. Connection design shall be submitted to the Architect-Engineer for review and approval.

D. Submittal Sequence: Connection design drawings and calculations must be submitted for approval to the Architect-Engineer to be concurrently reviewed, approved, and returned by the Architect-Engineer. Connection design submittal review comments made by the Architect-Engineer shall be incorporated into the related shop drawings prior to their submittal.

Submittals that do not comply with this requirement will be returned un-reviewed by the Architect-Engineer.

E. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

F. Qualification Data: For qualified Installer, fabricator, testing agency.

G. Welding certificates.

H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

I. Mill test reports for structural steel, including chemical and physical properties.

J. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

K. Source quality-control reports.

1.6 DESIGN CRITERIA FOR CONNECTIONS

A. Details shown are typical. Similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.

B. For non-composite steel members, connections shall be designed for the end reactions and transfer forces shown on the drawings. If no end reactions are shown, the connections shall be designed to support half of the total uniform load capacity shown in the AISC “Steel Construction Manual,” unless shown otherwise. For composite beams, connections shall be designed to support the reactions shown on the drawings.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD or a fabricator that has 5 years of experience for similar size and type projects.

B. Installer Qualifications: A qualified installer who has 5 years experience for similar size and type projects.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:

1. 2005 Code of Standard Practice for Structural Steel Buildings and Bridges AISC 303-05.
2. 2005 Seismic Provisions for Structural Steel Buildings AISC 341-05 and Seismic Provisions for Structural Steel Buildings Supplement No. 1 AISC 341s1-05.
3. 2005 Specification for Structural Steel Buildings AISC 360-05.
4. 2004 RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M , S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345).

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Refer plans for Standard, Extra strong, Double-extra strong.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

C. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Plain.

D. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
3. Finish: Plain.

2.3 PRIMER

A. Primer: Comply with Division 09 painting Sections.

B. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.

C. Primer: SSPC-Paint 23, latex primer.

D. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

E. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Available Products: (Equivalent Substitutions allowed only at architect’s approval.)
   a. Sherwin-Williams Company (The); Macropoxy 646 Fast Cure shall be applied to areas noted on drawings that shall be protected from an uncontrolled/exterior environment with a minimum of 2 coats of 5mils each.
   b. Surface preparation: SSPC-3, water-based degreasers as needed for compliance with the warranty, red-oxide color.

F. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
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/D1.1M.

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.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning."

F. 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/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass 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. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

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 (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.

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. SPC-SP 2, "Hand Tool Cleaning" or SPC-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 minimum dry film thickness of 1.2 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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 and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: 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 inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that 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.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. 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/D1.1M 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 A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

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: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M 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. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05 12 00

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SECTION 05 21 00 - STEEL JOISTS

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. K-series steel joists.
2. K-series steel joist substitutes.
3. Joist accessories.

1.3 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load deflections no greater than the following:

1. Roof Joists: Vertical deflection of 1/360 of the span.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

C. Welding certificates.

D. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

E. Field quality-control test and inspection reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

C. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications."

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/8 inch per 12 inches.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.

2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1/D1.1M.

C. Bolted connections will be visually inspected.

D. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

E. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

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SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.

B. Related Sections include the following:

1. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. 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.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Mechanical fasteners for sidelap fasteners.

G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. 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.

D. 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."

E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

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

1. Steel Deck:
    a. ASC Profiles, Inc.
    b. Canam Steel Corp.;The Canam Manac Group.
    c. Consolidated Systems, Inc.
    d. DACS, Inc.
    e. D-Mac Industries Inc.
    f. Epic Metals Corporation.
    g. Marlyn Steel Decks, Inc.
    h. New Millennium Building Systems, LLC.
    i. Nucor Corp.; Vulcraft Division.
    j. Roof Deck, Inc.
    k. United Steel Deck, Inc.
    l. Valley Joist; Division of EBSCO Industries, Inc.
    m. Verco Manufacturing Co.
    n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.

2. Profile Depth: As indicated.

3. Minimum Design Uncoated-Steel Thickness: 0.0474 inch (1.20 mm).
4. Span Condition: As indicated.

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.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) 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 (230 MPa), not less than 0.0359-inch (0.91-mm) 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 (230 MPa), 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. Galvanizing Repair Paint: ASTM A 780.

I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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. 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 mechanical or welded fasteners as indicated on drawings and as follows:

1. Fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws or 5/8” diameter puddles welds as noted on drawings.

2. Fastener Spacing: Fasten edge ribs of panels at each support. Space additional fasteners as noted on drawings.

3. Attach perimeter deck to angle supports at 6” O.C. maximum.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or as indicated on drawings, and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

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: Butted.

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

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SECTION 05 40 00 - COLD-FORMED METAL FRAMING

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. Exterior non-load-bearing wall framing.
2. Soffit joist framing.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Welding certificates.

D. Research/Evaluation Reports: For cold-formed metal framing.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H (ST230H).
2. Coating: G60 (Z180).

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50 (340), Class 1 or 2.
2. Coating: G90 (Z275).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inches (1.09 mm), unless noted otherwise on drawings.
2. Minimum Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inches (1.37 mm)
2. Flange Width: 1-1/2 inches.

C. Vertical Deflection Clip Option: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dietrich Metal Framing; a Worthington Industries Company.
   b. MarinoWare, a division of Ware Industries.
   c. SCAFCO Corporation
   d. The Steel Network, Inc.

D. Single Deflection Track Option: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

2.4 SOFFIT JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depth indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated on drawings.
2. Flange Width: 1-5/8 inches (41 mm) minimum.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.

4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Fast both flanges to top track if required by deflection option selected. Space studs as follows:

1. Stud Spacing: 8 to 16 inches, as indicated on drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Single Deflection Track Option: Install single-leg deflection tracks and anchor to building structure.

2. Deflection Clip Option: Connect vertical deflection clips to infill studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track Option: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at maximum 96-inch (2440-mm) centers and as shown on approved Shop Drawings.

2. Bridging Options:
    a. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
    b. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    c. Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

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SECTION 05 50 00 - METAL FABRICATIONS

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. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Steel weld plates and angles for casting into concrete not specified in other Sections.
3. Steel framing and supports for mechanical and electrical equipment.
4. Shelf angles.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 5 Section “Structural Steel Framing”

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

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

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. W-Shapes: ASTM A992/A992M.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 55, weldable.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

F. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, 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.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections**.**

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Available Products: (Equivalent Substitutions allowed only at architect’s approval.)
   a. Sherwin-Williams Company (The); Macropoxy 646 Fast Cure shall be applied to areas noted on drawings that shall be protected from an uncontrolled/exterior environment with a minimum of 2 coats of 5mils each.
   b. Surface preparation: SSPC-3, water-based degreasers as needed for compliance with the warranty, red-oxide color.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing.

1. Provide mitered and welded units at corners.

2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B**)** and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 40 00

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SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel pipe and tube railings.
2. Section 09 91 23 “Exterior Painting” for painting of interior and exterior rails.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Samples: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
    a. Show method of connecting and finishing members at intersections.

C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction. Engineer must be licensed in the State of Oklahoma.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
      d. Deflection limited to L/360 or 1/8 inch whichever is less.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.
      c. Deflection limited to L/360 or 1/8 inch whichever is less.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
   1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Malleable iron, ASTM A 47/A 47M, Grade 32510, galvanized.

2.5 FASTENERS

A. General: Provide the following:
   1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
   2. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
   1. 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.
   2. Material for Exterior Locations: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20, Type II-Organic, and the following:
   1. Zinc Content: 95 percent, minimum.
   2. Solids: 52 percent by volume, minimum.
   3. Dry film thickness not less than 1.5 mils per coat.
   4. Color: Flat grey finish matching original hot-dipped galvanizing.
   5. Available Product: ZRC Cold Galvanizing Compound; ZRC Worldwide.

C. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting."

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces at top rail or handrail smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces (NOMMA #1 finish). All other weld finishes shall be NOMMA #3.

I. Form Changes in Direction as Follows:
   1. Mitered.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

P. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
   1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize indicated steel railings, including hardware, after fabrication.
   2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
   3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
   4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with primers specified in Section 09 91 13 "Exterior Painting".
2. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

C. Leave anchorage joint exposed with 1/8-inch reveal in anchoring material. Seal with silicone joint sealant specified Section 07 92 00 “Joint Sealants.”

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting.""

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M and galvanizing repair paint manufacturer’s written instructions.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring and grounds.
4. Plywood backing panels.

B. Related Requirements:
1. Section 06 16 00 "Sheathing" for sheathing.
2. Section 31 31 16 "Termite Control" for site application of borate treatment to wood framing.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing agency.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. Application: Treat items indicated on Drawings, and the following:
   1. Framing for raised platforms.
   2. Concealed blocking.
   3. Roof framing and blocking.
   4. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Miscellaneous Framing: Construction or No. 2 grade of any species.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Furring.
   5. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 2 grade; SPIB.
   2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.

3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, marine grade in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
1. Locations: Electrical rooms, and IT rooms.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
1. Provide “J” bolts for installation in masonry bond beams.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.8 METAL FRAMING ANCHORS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wall sheathing.
2. Ballistic-resistant wall panels.
3. Soffit sheathing and accessories.

B. Related Requirements:
1. Section 06 10 53 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 07 27 26 “Fluid-Applied Membrane Air Barriers” for wall sheathing joint treatment and water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:
1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies 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 from UL's "Fire Resistance Directory."

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

2.4 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
   1. Span Rating: Not less than 32/16.
   2. Nominal Thickness: Not less than 1/2 inch.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corporation; GlasRoc.

b. G-P Gypsum Corporation; Dens-Glass.
c. National Gypsum Company; Gold Bond e(2)XP.
d. United States Gypsum Co.; Securock.

2. Type and Thickness: Type X, 5/8 inch thick.

C. Cementitious Backer Units: ASTM C 1325, Type A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. FinPan, Inc; Util-A-Crete Concrete Backer Board.
b. National Gypsum; PermaBase Brand Cement Board.
2. Thickness: 5/8 inch.

D. Ballistic-Resistant Wall Panels: Provide reinforced structural polyester laminate with fiberglass scrim in areas adjacent to ticket windows and other bullet resistant glazed areas.
1. Ballistic Resistance: Level 3 according to UL 752.
2. Panel Thickness: 7/16 inch minimum.
3. Sizes: 48 inches by 96 inches.

2.5 SOFFIT SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corporation; GlasRoc.
b. G-P Gypsum Corporation; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond e(2)XP.
d. Temple-Inland Inc.; GreenGlass
e. United States Gypsum Co.; Securock.
2. Type and Thickness: Type X, 5/8 inch thick.

B. Cementitious Backer Units: ASTM C 1325, Type A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. FinPan, Inc; Util-A-Crete Concrete Backer Board.
b. National Gypsum; PermaBase Brand Cement Board.
2. Thickness: 5/8 inch.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

G. Screws for Fastening Cementitious Backer Units to Cold-Formed Metal Framing: As recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating.

2.7 SOFFIT SHEATHING ACCESSORIES

A. Trim Accessories: Type as designated or required to suit conditions indicated; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard cell class for use intended, and ASTM C 1063.
   1. Casing Bead: Prefabricated, one-piece type.
   2. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
   3. Soffit Vents: Prefabricated, perforated, continuous, one-piece type, 2 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

2. Trim: Apply trim accessories at perimeter of soffits receiving acrylic plaster, at expansion joints, and elsewhere as indicated.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.
1. Trim: Apply trim accessories at perimeter of soffits receiving acrylic plaster, at expansion joints, and elsewhere as indicated.

END OF SECTION

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SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior cellular PVC simulated wood trim.

B. Related Requirements:
   1. Section 03 30 00 “Cast-In-Place Concrete” for landscape planters.
   2. Section 07 13 26 “Self-Adhering Sheet Waterproofing”, for waterproofing at landscape planters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:
   1. For cellular PVC trim, Full board width by minimum 12 inch length in size.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Cellular PVC trim.

B. Sample Warranties: For manufacturer's warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data for installed system.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 15 years producing PVC products.

B. Installer Qualifications: Minimum 3 years experience with installation of PVC trim products.

C. Allowable Tolerances:
   1. Variation in component length: -0.00 / +1.00”.
   2. Variation in component width: ± 1/16”.
   3. Variation in component thickness: ± 1/16”.
   4. Variation in component edge cut: ± 2°.
   5. Variation in Density: -0% + 10%.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store PVC materials in manufacturer’s original packaging and clearly identified.

B. Stack cellular PVC trim flat with spacers between each bundle to provide air circulation. Protect materials from weather and construction dust by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed. Do not apply deck and trim materials when the air temperature or relative humidity is outside the manufacturer's range limitations.

B. Excessive Static Electricity Buildup: Dry or windy conditions may create temporary static electricity buildup. Should this occur, remove loose debris from deck and trim surface and spray or mop entire surface with manufacturer's recommended diluted static control concentrate. Allow to air dry.

C. Allow at least 24 hours for materials to adapt to conditions at project site prior to installation.

1.8 WARRANTY

A. Manufacturer's Warranty for Cellular PVC Trim: Manufacturer agrees to repair or replace trim that fails due to defects in manufacturing within specified warranty period. Failures include, but are not limited to, deterioration, delamination, and excessive swelling from moisture.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Stain and Fade Warranty: Manufacturer's written materials warranty for long-term decking and railing performance against staining and color fade.
   1. Color Fade: Color change from light and weathering exposure not to exceed 5 Delta E (Hunter) units.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Performance Criteria for Decking Board And Trim Products: Comply with ASTM D7032. Refer to specified decking products for individual physical and mechanical property test results.

2.2 EXTERIOR TRIM

A. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized, rigid material.
   1. Basis-Of-Design Products: Subject to compliance with requirements, provide Trex Enhance Naturals, by Trex Company, Inc.; or comparable products by one of the following:
      a. Azek Company; Azek Trimboards.
      b. CertainTeed Corporation; CertainTeed Restoration Millwork.
      c. Ex-Cel Manufacturing, Inc.; Plasticlad.
      d. Fiberon, Fiber Composites LLC; Paramont or Horizon Collection.
      e. Fypon Ltd.; Fypon PVC.
      f. Gossen Corporation; WeatherReady Building Materials.
      g. Kleer Lumber, LLC; Kleer Trimboard.
      h. Kommerling USA, Inc.; Koma.
      i. Ply-Trim, Inc.; DuraBoard.
      j. Royal Mouldings Limited; Pro Series Exterior Mouldings.
      k. Vi-Lux Plastics Inc.; Cellular PVC.
      l. Wolfpac Technologies, Inc.; Versatex.
   2. Properties:
      a. Density: Not less than 31 lb/cu. ft..
      b. Heat Deflection Temperature: Not less than 130 deg F, according to ASTM D 648.
      c. Coefficient of Thermal Expansion: Not more than 4.5 x 10-5 inches/inch x deg F.
      d. Water Absorption: Not more than 1 percent, according to ASTM D 570.

e. Flame-Spread Index: 75 or less, according to ASTM E 84.
3. Size: 1 inch by 5-1/2 inches.
4. Finish: Smooth finish or woodgrain finish as indicated on the Drawings.
5. Color: Toasted Sand.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Provide screws, in sufficient length to penetrate not less than 1-1/2 inches into substrate.

B. General: Provide miscellaneous materials as recommended by the decking manufacturer.

C. Fasteners, General: Hidden Fasteners, type 316 stainless steel or polymer-coated composite decking screw fasteners complying with ASTM C1002. Minimum #8 by 2-1/2 inch length for face fasteners and #8 by 2-1/2 inch length for decking board ends.
1. Screw Withdrawal Capacity: 377 lbs. allowable per fastener; ASTM D1761.
2. Polymer-Coated Screw Fasteners: Comply with ASTM B117 for corrosion-resistance. Color-matched head.
3. Staples, small brads and wire nails must not be used as fastening members.
4. Fasteners must be installed no more than 2” from the end of each board.

D. Adhesive for Cellular PVC Trim: Product recommended by trim manufacturer.
1. The glue joint should be secured with a fastener and/or fastened on each side of the joint to allow adequate bonding time.

E. Sealants: Latex, complying with ASTM C 834 Type C, Grade 0 deg C, and with applicable requirements in Section 07 92 00 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.
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. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. May National Associates, Inc.; Bondaflex Sil-A 700.
d. Pecora Corporation; AC-20+.
e. Schnee-Morehead, Inc., an ITW company; SM 8200.
f. Tremco Incorporated; Tremflex 834.

2.4 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Clean cast-in-place concrete substrates of projections and substances detrimental to application.

B. Install self-adhering waterproofing as specified in Section 07 13 26 “Self-Adhering Sheet Waterproofing” over concrete planters prior to installation of cellular PVC trim.

C. Where custom painting of PVC trim is noted on the Drawings, prime trim to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 09 91 13 "Exterior Painting."

3.3 INSTALLATION, GENERAL

A. Manufacturer instructions:
   1. Comply with cellular PVC manufacturer’s product catalog installation instructions and product technical bulletin instructions.

B. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
   1. Do not use manufactured units with defective surfaces, sizes, or patterns.

C. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   3. When properly fastened, allow 1/8” per 18 foot of PVC product for expansion and contraction.
   4. Coordinate exterior finish carpentry with materials and systems in or adjacent to it..

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install cellular PVC trim to comply with manufacturer's written instructions.

B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary.
   1. Use scarf joints for end-to-end joints.
   2. Stagger end joints in adjacent and related members.
   3. Edge Finishing: Edges can be finished by sanding, grinding or filing with traditional woodworking tools.

C. Fit exterior joints to exclude water, and to eliminate joint separation. For long runs of PVC trim, allow for expansion and contraction at ends of the run. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
   1. Use 2 fasteners per every framing member for trimboard applications.
   2. Fasteners must be installed no more than 2” from the end of each board.

3.5 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior trim.
2. Interior board paneling.
3. Shelving.

B. Related Requirements:
1. Section 06 1053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 09 91 23 "Interior Painting" for priming and backpriming of interior finish carpentry.
3. Section 09 93 00 “Staining and Transparent Finishing.”

1.2 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. MDO: Plywood with a medium-density overlay on the face.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Shop Drawings: For millwork, show location of cut outs, connections with adjacent materials, installation details, and material placement.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

C. Samples for Verification:
1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish,

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:
   1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
   2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
   3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
   4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
   5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
   6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

C. Softwood Plywood: DOC PS 1.

D. MDF: ANSI A208.2, , made with binder containing no added urea-formaldehyde resin.

E. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no added urea-formaldehyde resin.

F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
   1. Color: Match Architect's samples.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.

2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
    a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
    a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: Where indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
    1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.

D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
    1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
    2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

F. Application: All interior lumber and plywood.

2.4 INTERIOR TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
    1. Species and Grade: As indicated on Drawings; A Finish; NHLA.
    2. Maximum Moisture Content: 9 percent.
    3. Finger Jointing: Not allowed.
    4. Gluing for Width: Use for lumber trim wider than 6 inches.
    5. Veneered Material: Use for lumber trim wider than 6 inches.
    6. Face Surface: Surfaced (smooth) or saw textured as indicated.

7. Matching: Selected for compatible grain and color.
8. Profile: Ease edge of hardwood base.
9. Sheen: Satin unless noted otherwise.

B. Lumber Trim for Opaque Finish (Painted Finish):
1. Species and Grade: White woods, 1 Common; WWPA.
2. Maximum Moisture Content: 10 percent.
3. Finger Jointing: Not allowed.
4. Face Surface: Surfaced (smooth).
5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

2.5 PANELING (WD1)

A. Board Paneling: Interior wood-board paneling complying with WMMPA WM 9.
1. Species: Custom Nano Teak, Accoya Smooth finish; by Delta Millworks.
2. Grade: Clear No. 1.
3. Maximum Moisture Content: 9 percent.
4. Pattern: V-joint, tongue and groove, PT 82.
5. Net Coverage Width: Not less than 5-13/16 inches (6-inch nominal width).
6. Thickness: 5/8 inches.

2.6 SHELVING

A. Closet and utility Shelving: Made from one of the following materials, 3/4 inch thick.
1. MDF with solid-wood front edge.
2. Melamine-faced particleboard with applied-PVC front edge.

B. Shelf Cleats: 3/4-by-3-1/2-inch boards, as specified above for shelving.

C. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.

D. Hidden shelf bracket: Shelf to be a minimum of 1 5/8” thick. Bracket is pocketed within shelf edge. Finish: Zinc.
1. Richelieu, #500922G.

E. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102andoized steel.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.8 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:
1. Interior standing and running trim except shoe and crown molds.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
   3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
   1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
   2. Install trim after gypsum-board joint finishing operations are completed.
   3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
   1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners and adhesive as recommended by panel manufacturer.
   2. Conceal fasteners to greatest practical extent.
   3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

B. Board Paneling: Install according to manufacturer's written instructions. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
   1. Install in full lengths without end joints.
   2. Stagger end joints in random pattern to uniformly distribute joints on each wall.
   3. Install with uniform end joints with only end-matched (tongue-and-groove) joints within each field of paneling.
   4. Install with uniform end joints. Locate end joints only over furring or blocking.
   5. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
   6. Fasten paneling by face nailing, setting nails, and filling over nail heads.
   7. Fasten paneling with trim screws, set below face and filled.
   8. Fasten paneling by blind nailing through tongues.
   9. Fasten paneling with paneling system manufacturer's concealed clips.
   10. Fasten paneling to gypsum wallboard with panel adhesive.

3.6 SHELVING INSTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.

B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c. Use 2 fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.
   1. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing. Remove adhesive that is squeezed out after fastening shelf cleats in place.

C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

D. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.
   1. Fasten shelves to cleats with finish nails or trim screws, set flush.
   2. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

3.7 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.8 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.9 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
   2. Section 12 36 61 "Simulated Stone Countertops."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials, and cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
   3. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
   2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
   3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
   4. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For the following:
   1. Composite wood products.
   2. Thermoset decorative panels.
   3. High-pressure decorative laminate.
   4. Adhesives.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS (L1, L2)

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide labels or certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Legend by Formica Corporation, or comparable product by one of the following:
      a. Abet Laminati, Inc.
      b. Panolam Industries International, Inc.
      c. Wilsonart International; Div. of Premark International, Inc.

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: Grade VGS.
   5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      a. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
      a. Minimum thickness between 1/2” to 5/8”.
   3. Drawer Bottoms: Thermoset decorative panels.
      a. Drawer bottoms up to 29” to have a minimum thickness to be ¼”.
      b. Drawer bottoms over 30” to have a minimum thickness to be ½”

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Constructions: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated by laminate manufacturer's designations.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 8 to 13 4 to 9 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
   2. Softwood Plywood: DOC PS 1, medium-density overlay.
      a. Plywoods are not to be used as Through Color Laminate substrates.
   3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
      a. Plywoods are not to be used as Through Color Laminate substrates.
   4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 10 "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.
   1. Top Knobs, Pennington Bar Pull 5-1/16 inch, Ashbury Collection:
      a. Finish: Polished Nickel Finish.
      b. Style: Contemporary.
      c. Location: As indicated.

D. Shelf Rests: BHMA A156.9, B04013; metal.

E. Drawer Slides: BHMA A156.9.
   1. Manufacturers:
      a. KV.
      b. Blum.
      c. Accuride.
      d. Others as approved by Architect.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
   4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
   5. For computer keyboard shelves, provide Grade 1HD-100.
   6. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.

F. Door Locks: BHMA A156.11, E07121.
   1. Basis of Design: Olympus.
   2. Keying: TBD.
   3. Scope: TBD.

G. Drawer Locks: BHMA A156.11, E07041.
   1. Basis of Design: Olympus.
   2. Keying: TBD.
   3. Scope TBD.

H. Door and Drawer Silencers: BHMA A156.16, L03011.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain added urea formaldehyde.
   1. Through Color Laminates: Do not use adhesives that contain added pigments for resorcinols.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate cabinets to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
   1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips, and No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING (FRP1)

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
   1. Manufacturers: Subject to compliance with requirements, provide product indicated on Finish Schedule, Marlite FRP S100 4 ft. x 8 ft.; or comparable products by one of the following:
      a. Crane Composites, Inc.
      b. Nudo Products, Inc.
   2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 200 or less.
      b. Smoke-Developed Index: 450 or less.
   3. Nominal Thickness: Not less than 0.09 inch.
   4. Surface Finish: Molded pebble texture or Smooth, as selected by Architect.
   5. Color: White, unless otherwise indicated.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: Match adjacent panels.

B. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.

C. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."
   1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
   2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 07 13 26 – SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following waterproofing materials for vertical and horizontal interior concrete surfaces at landscape planters:
   1. Modified bituminous “peel and stick” sheet waterproofing.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current sheet membrane.

1.3 SUBMITTALS

A. Product Data for each type of waterproofing specified, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties.

B. Shop Drawings showing locations and extent of waterproofing, including details for substrate joints and cracks, sheet flashings, penetrations, tie-ins with adjoining construction, and other termination conditions.

C. Samples, 3-by-6-inch (75-by-150-mm) minimum size, of each waterproofing material required for Project.

D. Installer certificates signed by manufacturer certifying that Installers comply with requirements under the "Quality Assurance" Article.

E. Warranty: Specimen of specified waterproofing warranty.

F. Product test reports from a qualified independent testing agency evidencing compliance of waterproofing with requirements and other physical properties reported by manufacturer based on comprehensive testing of products according to current standard test methods within previous 5 years.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is certified in writing by waterproofing manufacturer as qualified to install manufacturer's waterproofing.

B. Single-Source Responsibility: Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing waterproofing.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination."
   1. Before installing waterproofing, meet with Owner, Architect, consultants, independent testing agency, waterproofing manufacturer, and other concerned entities.
   2. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, inspection and testing procedures, and protection and repairs.
   3. Notify participants at least 7 days before conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written “total systems” warranty signed by Contractor, waterproofing manufacturer and Installer agreeing to repair or replace waterproofing that does not meet requirements or that does not remain watertight during the specified warranty period. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.
   1. Warranty Period: 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POST-INSTALLED SELF-ADHERING COMPOSITE SHEET

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Rubberized-Asphalt Composite Sheet:
      a. Grace, W. R. & Co.; Bituthene 3000/Low Temperature or Bituthene 4000.
         1) Basis of Design.
      b. Comparable products by other manufacturers also acceptable.

B. Rubberized-Asphalt Composite Sheet: 60-mil- (1.5-mm-) thick self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
   1. Physical Properties: Provide waterproofing complying with the following:
      a. Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
      b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
      c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
      d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3.2-mm) movement; ASTM C 836.
      e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
      f. Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.

g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
h. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing sheet membrane.
1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Primer: Liquid VOC compliant primer recommended by manufacturer of sheet waterproofing material for substrate.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Flashing: Self-adhering, rubberized-asphalt composite sheet of same material, construction, and thickness as waterproofing sheet membrane.

E. Liquid Membrane: Elastomeric, 2-component, liquid, cold fluid-applied, trowel grade or low viscosity as recommended by waterproofing manufacturer for application.

F. Substrate Patching Membrane: Low-viscosity, 2-component, asphalt-modified coating.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches (114 mm) wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (225-mm) centers.

I. Protection Course: Semirigid sheets of fiberglass or mineral-reinforced asphaltic core, pressure laminated between 2 asphalt-saturated fibrous liners and as follows:
1. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, and sound; and ready to receive sheet.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage affecting other construction.

C. Remove grease, oil, form release agents, paints, and other penetrating contaminants from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D 4258.

F. Inside Corners: Prepare, prime, and treat inside corners according to waterproofing manufacturer's written instructions.
   1. Install membrane strip centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
      a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.

G. Outside Corners: Prepare and treat outside corners according to waterproofing manufacturer's written instructions.
   1. Install strip of membrane 12 inches (300 mm) wide, centered over corner.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to waterproofing manufacturer's written instructions.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrate at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing membrane in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheet membrane over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
   1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Apply continuous sheet membrane over membrane strips bridging each type of joint to dimensions indicated or required by manufacturer.

E. Seal exposed edges of membrane terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

F. Install sheet membrane and auxiliary materials to tie in adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not meeting requirements. Slit and flatten fishmouths and blisters. Patch with sheet membrane extending 6 inches (150 mm) beyond repaired areas in all directions.

H. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION COURSE INSTALLATION

A. Install protection course with butted joints over waterproofing membrane before starting subsequent construction operations.

3.5 FIELD QUALITY CONTROL

A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

B. Owner will engage an independent testing agency to perform field inspections, sample and test materials being used, and report whether tested Work conforms to or deviates from requirements.
   1. Testing agency will examine terminations for evidence of leaks.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

D. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

3.6 PROTECTING AND CLEANING

A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 19 00 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
   1. Cast stone.
   2. Exposed concrete unit masonry.

B. Related Requirements:
   1. Section 04 20 00 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of water repellent.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, for preconstruction testing, and to set quality standards for materials and execution.
   1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
      a. Size: 25 sq. ft. each.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
   1. Concrete surfaces and mortar have cured for not less than 28 days.
   2. Building has been closed in for not less than 30 days before treating wall assemblies.
   3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
   4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
   5. Rain or snow is not predicted within 24 hours.
   6. Not less than 24 hours have passed since surfaces were last wet.
   7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance: Water repellents shall meet the following performance requirements as determined by preconstruction testing on manufacturer's standard substrates representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
   1. Cast Stone: ASTM C 1195.
   2. Concrete Masonry Units: ASTM C 140.

C. Water-Vapor Transmission: Comply with one or both of the following:
   1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E 96/E 96M.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E 514/E 514M.

E. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G 154 compared to water-repellent-treated specimens before weathering.

2.2 PENETRATING WATER REPELLENTS

A. Solvent-Based Silicone Elastomer, Penetrating Water Repellent: Clear water repellent with 100 g/L or less of VOCs, and protects treated surfaces from repeated graffiti attacks without altering the natural appearance.
   1. Products: Subject to compliance with requirements, provide the following, or approved equivalent by other manufacturers:
      a. PROSOCO, Inc.; Sure Klean Weather Seal Blok-Guard & Graffiti Control Ultra.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
   1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
   2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
   3. Verify that required repairs are complete, cured, and dry before applying water repellent.

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

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:
   1. Cast Stone, and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coatings of water repellent on surfaces to be treated using 15 psi-pressure spray with a fan-type spray nozzle to the point of saturation. Apply coatings in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
   1. Cast Stone: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.

C. Apply first coating of water repellent at the following locations:
   1. At exposed interior face of CMU within the Arena space and Expo locations.
   2. Exposed cast stone.

D. Apply a second saturation coating at exposed interior face of CMU at Arena Wash Bay locations (at north wall between grids 3 and 13, and room 01.15.09 between grids K and L.7), repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

E. Apply a third saturating coating at exposed interior face of CMU at Arena Wash Bay locations (at north wall between grids 3 and 13, and room 01.15.09 between grids K and L.7), repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.
3. Mineral-wool blanket.

B. Related Requirements:
1. Section 04 20 00 "Unit Masonry" for insulation installed in masonry cells.
2. Section 07 21 19 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
3. Section 07 54 23 "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
4. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.
4. Store boards at least 4 inches off the ground on pallets. Open bundle packaging on both short ends to ventilate. Cover with waterproof tarp and secure.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded Polystyrene Board, Type IV Insert drawing designation: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Amoco Foam Products Company.
      b. DiversiFoam Products.
      c. Dow Chemical Company (The).
      d. Owens Corning.
      e. Pactiv Corporation.
   2. Thickness: As indicated on Drawings.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. CertainTeed Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens-Corning Fiberglas Corporation.
      e. Schuller International, Inc.

2.3 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Products: Subject to compliance with requirements, provide products by one of the following manufacturers:
      a. Industrial Insulation Group, LLC (IIG-LLC); MinWool Sound Attenuation Fire Batt.
      b. Roxul Inc.
      c. Thermafiber, Inc.; an Owens Corning company.

B. Mineral-Wool Blanket, Reinforced-Foil Faced : ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Industrial Insulation Group, LLC (IIG-LLC);
      b. Roxul Inc;
      c. Thermafiber, Inc.; an Owens Corning company.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. AGM Industries, Inc; Series T TACTOO Insul-Hangers.

b. Gemco; Spindle Type.
2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
1. Products: Subject to compliance with requirements, provide one of the following:
a. AGM Industries, Inc; RC150 or SC150.
b. Gemco; R-150 or S-150.

C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.
1. Products: Subject to compliance with requirements, provide the following:
a. Gemco; Double Clutch Clip.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
a. AGM Industries, Inc; TACTOO Adhesive.
b. Gemco; Tuff Bond Hanger Adhesive.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

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

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

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

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

B. Butt panels together for tight fit.

C. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
   2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
   3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
   4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

D. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket or Flexible Board Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   6. Insulation shall be installed so thermal barrier runs continuous.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 21 11 – PRE-ENGINEERED BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pre-Engineered Building Insulation for New Construction.

B. Related Requirements:
   1. Section 07 21 00 “Thermal Insulation.”
   2. Section 13 34 19 “Metal Building Systems” for pre-engineered building assemblies.
   3. Division 21 Section on Fire Protection Systems.
   4. Division 23 Sections on Mechanical rough-in utilities.
   5. Division 26 Sections on Electrical rough-in utilities.

1.2 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure B).

C. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

E. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

F. ASTM C 1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

1.3 DESIGN REQUIREMENTS

A. Thermal Resistance of Installed System: R-Value as indicated on Drawings.

B. Insulating system shall have a continuous vapor barrier inside of building purlins, girts, and insulation to provide complete isolation from inside conditioned air.
   1. Taping or stapling of vapor retarder lap joints is not acceptable. Sealing field joints with a permanent vapor retarder lap sealant is required. Field seams, if any, shall be made on a structural member and mechanically attached with a steel strap and fasteners along its full length.

C. The installed liner system shall also provide the following OSHA-required compliances to save and protect contractors, workers, inspectors, and other individuals (29 CFR-1926.751 “Controlling Contractors”) from injury, penalty and liability, without added cost:
   1. Through fall protection (29 CFR-1926.501, 1926.760).
   2. Protection from falling objects (29 CFR-1926.759).
   3. Protection from falls through roof openings (29 CFR-1926.759).
   4. Product-related project safety training (29 CFR-1926.761).
   5. Product-related project specific safety plan (29 CFR-1926.752).

1.4 ACTION SUBMITTALS

A. 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 instructions.
4. Detailed training instructions, project specific safety drawings, and plans for OSHA safety compliance as an alternative form of through fall protection in metal building structures.

B. Shop Drawings: Indicate locations of connections and attachments, general details, anchorages and method of anchorage and installation.
1. Show purlin spacings, support strap locations and spacings, fastening points, liner system fabric sizes and locations; insulation widths and thicknesses, sizes and locations.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square or long, representing actual products required for this project.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

C. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing product systems specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section, with personnel trained by manufacturer on proper installation procedures.

C. Insulation system components to include a ten-year limited material warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.8 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain insulation materials and accessories from single manufacturer.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Thermal Design, Inc., Simple Saver System; or comparable insulation products by other manufacturers, including but not limited to the following:
1. Owens Corning Insulating Systems, LLC; OptiLiner System.
2. Lamtec Corporation.

2.2 MATERIALS

A. Simple Saver System consists of Batt Insulation, Roof Insulation, Vapor Barrier Liner Fabric, Thermal Breaks, Straps, and other devices and components in a proprietary insulation system as follows:

1. Batt Insulation: ASTM C 991 Type 1; preformed formaldehyde-free glass fiber batt conforming to the following:
   a. Thermal Resistance: R-19, unless otherwise indicated on drawings.
   b. Batt Size: Equal to purlin/girt spacing by manufacturer's standard lengths.
   c. Unfaced.
   d. Other batt insulation meeting ASTM C991 Type 1, ASTM E136 and ASTM E84 as recommended and submitted by the system manufacturer and approved by the Architect during submittal is also acceptable.
2. Roof Insulation: Formaldehyde-free fiberglass batt or fiberglass blanket complying with ASTM C 991 Type 1 and ASTM E 84 with a thermal resistance and thickness as follows:
   a. R-11; 3-1/2 inches (89 mm), unless otherwise indicated on drawings.
3. Vapor Barrier Liner Fabric: Syseal® type woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene coatings, as follows:
   a. Product complies with ASTM C 1136, Types I through Type VI.
   b. Perm rating: 0.02 for fabric and for seams in accordance with ASTM E 96; or not function as a vapor retarder but shall be perforated with 3/16" minimum holes space not more than four (4) inches apart in each direction.
   c. Flame/Smoke Properties:
      1) Class A Compliant with flame spread index 25/50 in accordance with ASTM E 84.
      2) Self-extinguishes with field test using matches or butane lighter.
   d. Ultra violet radiation inhibitor to minimum UVMAX® rating of 8.
   e. Size and seaming: Manufactured in large custom pieces by extrusion welding from roll goods, and fabricated to substantially fit defined building area with minimum practicable job site sealing.
   f. Provide with factory double, extrusion welded seams. Stapled seams or heat-melted seams are not acceptable due to degradation of fabric.
   g. Factory-folded to allow for rapid installation.
   h. Color:
      1) White.
   i. Fabric shall be certified for fall protection by the manufacturer.
4. Vapor Barrier Lap Sealant: Solvent-based, Simple Saver polyethylene fabric adhesive.
5. Vapor Barrier Tape: Double-sided sealant tape 3/4 inch (19 mm) wide by 1/32 inch (.79 mm) thick.
6. Vapor Barrier Patch Tape: Single-sided, adhesive backed sealant tape 3 inches (76 mm) wide made from same material as Syseal® type liner fabric.
7. Thermal Breaks:
   a. Polystyrene Snap-R snap-on thermal blocks.
8. Straps:
   a. 100 KSI minimum yield tempered, high-tensile-strength steel.
   b. Size: Not less than 0.020 inch (0.50 mm) thick by 1 inch (25 mm) by continuous length.
   c. Galvanized, primed, and painted to match specified finish color on the exposed side.
   d. Color:
      1) White.
   e. Traverse strap pattern shall include one strap six (6) inches away from each rafter flange with the remaining space between rafters divided into equal spaces not to exceed five (5) feet. Longitudinal straps shall be nominally thirty (30) inches on-center, with two adjacent straps at the ridge line.

9. Fasteners:
   a. For light gage steel: #12 by 3/4 (19 mm) inch plated self-drilling Tek 2 type screws with sealing washer, painted to match specified color.
   b. For heavy gage steel: #12 by 1-1/2 inch (38 mm) plated self-drilling Tek 4 type screws with sealing washer, painted to match specified color.
   c. Always install two (2) fasteners in the end of each strap for safety and to withstand installation stress, and one (1) fastener at all other designated fastening points.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building structure including all bracing and any concealed building systems are completed and approved prior to installing liner system and insulation in the structure.

B. Correct any unsatisfactory conditions before proceeding.
   1. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

C. If conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION – GENERAL

A. Install pre-engineered building insulation system in accordance with manufacturer's installation instructions and the approved shop drawings.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

D. Install in exterior spaces without gaps or voids. Do not compress insulation.

E. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

F. Fit insulation tight in spaces and tight to exterior side of the sealed liner fabric and around mechanical and electrical services within plane of insulation.

3.3 SAFETY PRECAUTIONS

A. Installation contractor must have a site-specific safety plan and comply with all OSHA applicable local rules and regulations when installing this system.

B. Workers must use OSHA required fall protection when installing the liner system (refer to OSHA regulations 29 CFR 1926, Subpart M).

3.4 ROOF INSULATION INSTALLATION

A. Straps:
   1. Cut straps to length and install in the pattern and spacings indicated on shop drawings.
   2. Tension straps to required value.

B. Vapor Barrier Fabric:
   1. Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing.
   2. Position pre-folded fabric on the strap platform along one eave purlin.

3. Clamp the two bottom corners at the eave and also centered on the bay.
4. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on the opposite ridge purlins.
5. Once positioned, install fasteners from the bottom side at each strap/purlins intersection.
6. Trim edges and seal along the rafters.
7. All seams must be completely sealed and stapled seams not acceptable.

C. Insulation:
1. Unpack, and shake to a thickness exceeding the specified thickness.
2. Ensure that cavities are filled completely with insulation.
3. Place on the vapor barrier liner fabric without voids or gaps.
4. Place top layer of insulation over and perpendicular to the purlins without voids or gaps, as roof sheathing is applied.
5. Place thermal block on top of purlins or bottom of purlins.
6. Place new insulation between purlins at the required thickness for the R-value specified.

D. Seal vapor barrier fabric to the wall fabric and elsewhere as required to provide a continuous vapor barrier.

3.5 CLEANING

A. Clean dirt or exposed sealant from the exposed vapor barrier fabric.

B. Remove scraps and debris from the site.

3.6 PROTECTION

A. Protect system products until completion of installation. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Repair or replace damaged products before completion of insulation system installation.

END OF SECTION

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SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Closed-cell spray polyurethane foam at interior of canopy steel support tubes.

B. Related Requirements:
   1. Section 07 21 00 "Thermal Insulation" for foam-plastic board insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

D. NFPA 285 testing results.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide products of BASF Polyurethanes North America or comparable products by one of the following:
      a. Bayer MaterialScience LLC.
      b. CertainTeed Corporation.
      c. Dow Chemical Company (The).
      d. Icynene, Inc.
      e. Owens Corning.
   2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 75 or less.
      b. Smoke-Developed Index: 450 or less.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Cavity: Install into cavities to fully fill void.

3.3 PROTECTION

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

END OF SECTION

SECTION 07 24 19 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
   2. Water-resistive coatings.

B. Related Requirements:
   1. Section 07 92 00 "Joint Sealants" for sealing joints in EIFS with elastomeric joint sealants and for perimeter joints between system and other materials.

1.2 DEFINITIONS

A. Definitions in ASTM E 2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. IBC: International Building Code.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistive coatings.

B. Shop Drawings: Plans, elevations and sections as required to show installation of product and coordination with adjacent building materials.

C. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
   1. Include similar Samples of exposed accessories involving color selection.

D. Samples for Verification: 24-inch-square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including custom trim, each profile, and an aesthetic reveal.
   1. Include exposed trim and accessory. Samples to verify color selected.
   2. Include a typical control joint filled with sealant of color selected, as specified in Section 07 92 00 "Joint Sealants."

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer certifying the following:
   1. EIFS complies with requirements.
   2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
   3. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive coatings, and trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Product Certificates: For cementitious materials and aggregates and for insulation and joint sealant, from manufacturer.

D. Product Test Reports: For each EIFS assembly and component, and for water-resistive coatings, for tests performed by a qualified testing agency.

E. Field quality-control reports and special inspection reports.

F. Evaluation Reports: For EIFS, including insulation fasteners, water-resistive coatings, and flexible membrane flashing, from ICC-ES.

G. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
   1. Stack insulation board flat and off the ground.
   2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Bond integrity and weather tightness.

b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
   a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
   b. Insulation installed as part of EIFS including foam build-outs.
   c. Insulation adhesive.
   d. EIFS accessories, including trim components and flashing.
   e. Water-resistive coatings.
   f. EIFS drainage components.
3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dryvit Systems, Inc., Outsulation; or comparable product by one of the following:
   1. BASF Wall Systems.
   2. Omega Products International, Inc.
   3. Parex USA, Inc.
   4. Sto Corp.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E 2568 and ICC-ES AC219 and with the following:
   1. Weather tightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
   2. System Fire Performance: Full-scale multistory fire test.
   3. Structural Performance: EIFS assembly and components shall comply with ICC-ES AC219 when tested according to ASTM E 2568.
      a. Wind Loads: Uniform pressure as indicated on Drawings.
   4. Impact Performance: ASTM E 2568, High impact resistance unless otherwise indicated.
   5. Bond Integrity: Free from bond failure within EIFS components or between EIFS and substrates, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
   6. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch-thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested according to ASTM D 968, Method A.
   7. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274.

2.3 EIFS MATERIALS

A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive.

B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water-resistive barriers; compatible with substrate and complying with physical and performance criteria of ASTM E 2570.

C. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with one of the following:
1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
2. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

E. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; and EIFS manufacturer's requirements for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.
3. Dimensions: Provide insulation boards of not more than 24 by 48 inches and in thickness indicated, but not more than 4 inches thick or less than the thickness allowed by ASTM C 1397.
4. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical-drainage channels, slots, or waves on the back side of board.
5. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E 2098 and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to meet impact-performance level specified in "Performance Requirements" Article.

G. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following:
1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

I. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Color: Canvas, as indicated by manufacturer's designations.
3. Textures: Sandpebble Fine Texture, as indicated by manufacturer's designations .

J. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

K. Water: Potable.

L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard cell class for use intended, and ASTM C 1063.
   1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
   2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
   3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
   4. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Begin coating application only after surfaces are dry.
   2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

A. Primer/Sealer: Apply over sheathing substrates and where required by EIFS manufacturer for improving adhesion of insulation to substrate.

B. Water-Resistive Coating: Apply over sheathing to provide a water-resistive barrier.
   1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.

C. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where required by EIFS manufacturer. Prime substrates if required and install flashing to comply with EIFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.
   1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
   2. Expansion Joint: Use where indicated on Drawings.
   3. Casing Bead: Use at other locations.

3.6 INSULATION INSTALLATION

A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397 and the following:
   1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
   2. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
   3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or applying base coat and reinforcing mesh.
   4. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
   5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
   6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.
      a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
   7. Apply channeled insulation with drainage channels aligned vertically.
   8. Interlock ends at internal and external corners.
   9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
   10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
   11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.

12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
13. Install foam build-outs and attach to sheathing.
14. Interrupt insulation for expansion joints where indicated.
15. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
16. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
17. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
18. Treat exposed edges of insulation as follows:
    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
    c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
19. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE-COAT INSTALLATION

A. Waterproof Adhesive/Base Coat: To exposed surfaces of insulation, apply in minimum thickness recommended in writing by EIFS manufacturer over foam build-outs where indicated on Drawings.

B. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.

E. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
   1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
   2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

F. Foam Build-Outs: Fully embed reinforcing mesh in base coat.

G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. As stipulated in Ch. 17 of the IBC.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. EIFS Tests and Inspections: According to ASTM E 2359 and ICC-ES AC219.

D. EIFS will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, services and equipment required in conjunction with or properly incidental to the installation of under-slab vapor retarders described herein and/or as shown on the drawings.

1.2 RELATED WORK

A. Section 03 30 00: Cast-In-Place Concrete.

1.3 JOB CONDITIONS

A. Subbase: Smooth and level, free from damaging protrusions that would puncture vapor retarder.

1.4 REFERENCES

A. ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs: Exceeds Class B

C. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E 154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

E. ASTM D 1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

F. ASTM F 1249 – Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

G. ACI 302.1R – Vapor retarder component (plastic membrane) not less than 10 inches thick.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product Data: Provide manufacturers printed product literature and description, including tests and standards that have been performed on the vapor retarder material.

C. Samples: Submit two, 8 1/2 x 11 inch in size, illustrating the vapor retarder and two (2) 8-1/2-in long sample strips of the joint tape.

D. One each of all accessories that will be used in the installation.

E. Verification by Independent testing labs indicating that materials comply with specified requirements.

F. Certificates: Certify that products of this section meet or exceed specified requirements.

G. Manufacturer's Instructions: Indicate complete installation instructions.

PART 2 - PRODUCTS

2.1 AVAILABLE PRODUCTS

A. Stego Wrap 15 mil Vapor Retarder by Stego Industries, L.L.C.

B. Perminator™ 15 mil by W.R. Meadows .

C. Griffolyn Type-105 (minimum 15-mil thick) by Reef Industries, Inc.

D. Vapor Block 15 (mil) by Raven Industries, Inc.

E. Moistop Ultra 15 (mil) by Fortifiber Building Systems Group

2.2 SOURCE QUALITY CONTROL AND TESTING

A. Vapor retarder membrane shall have following properties:

1. Water Vapor Retarder: Meets or exceeds Class A according to ASTM E 1745.
2. Water Vapor Transmission Rate: 0.012 grains/ft2/hour or lower according to ASTM E 96.
3. Water Vapor Permeance: 0.024 perms or lower according to ASTM E 154 Sec. 7 or F 1249 (max.).
4. Tensile Strength: 45.0 lbf/in according to ASTM E 154 Sec. 9. .
5. Puncture Resistance: 2200 g according to ASTM D 1709, Method B

2.3 ACCESSORIES

A. Tape:

1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4".

B. Pipe Boot:

1. Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer's instructions

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are acceptable for the placement of the vapor retarder.

3.2 PREPARATION

A. Ensure that subsoil is approved by Geotechnical Engineer.

1. Vapor Retarder shall be installed on top of the aggregate, sand or tamped earth base or carton forms. At carton forms provide a vertical leg down to grade and adhered the vapor retarder to the grade beam at or just below the dirt line. Vapor retarder may be placed either above or beneath any carton form slip sheet.

3.3 INSTALLATION

A. Install vapor retarder per manufacturer's instructions, illustrations and ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

1. Level and tamp or roll granular base.
2. Place Vapor Retarder with the longest dimension parallel with the direction of the pour.
3. Lap Vapor Retarder over footings and seal to foundation walls. Seal all penetrations.
4. Lap joints 6 inches and seal with the recommended pressure sensitive tape.
5. Seal pipe penetrations with pipe boot made from vapor retarder and tape.
6. Protect vapor retarder from damage during installation of reinforcing steel and utilities.
7. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with pressure sensitive tape.

3.4 INTERFACE WITH OTHER WORK

A. Coordinate work of all other trades related to the slab base and utility services.

END OF SECTION 07 26 00

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SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fluid-applied, vapor-permeable membrane air barriers, including substrate joint treatment.

B. Related Requirements:
   1. Section 06 16 00 "Sheathing" for wall sheathings.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

D. Water vapor permeability: Time rate of water vapor transmission through a material at a specific thickness.

E. Water vapor transmission: Rate of water transmission through a material of a constant thickness at a given time. The method of testing is ASTM E96.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
   2. Review application thickness and quality assurance of thickness.
   3. Discuss connections from air barrier to adjacent surfaces including transition strips.
   4. Review application temperature and inservice temperature of wall.
   5. Review walls to receive air barriers and identify substrate cracks and methods to bridge cracks.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   2. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
   1. Include NFPA 285 testing results for exterior wall assemblies or engineering judgements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Single-Source Responsibility: Obtain all air barrier materials and accessories from a single manufacturer unless approved by Architect. Manufacturer shall be regularly engaged in manufacturing air barriers.

C. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
   1. Build integrated mockups of exterior wall assembly as shown on Drawings, but not less than 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
      a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
      b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
      c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
   1. Qualitative Air-Leakage Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
   2. Adhesion Testing: Mockups will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541.
   3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283 or ASTM E 783.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies (Grace Construction Products) Perm-A-Barrier VPL or comparable product (with minimum dry mil thickness of 40 mil) by one of the following:
      a. Carlisle Coatings & Waterproofing Inc.
         1) Barritech VP.
      b. Henry Company, Sealants Division.
   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
         1) Assembly Air Permeance: Requirements above when tested in accordance with ASTM E2357.
      b. Vapor Permeance: Minimum 10 perms; ASTM E 96, Method B.
      c. Fire Propagation Characteristics: Basis-of-Design product is part of an approved wall assembly that passes NFPA 285 testing. Do not submit comparable products without coordination of compliance.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Modified bituminous, 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, cross-laminated polyethylene film with release liner backing.

D. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

E. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.

F. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

J. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

K. Vapor-Retarding Nonbituminous Self-Adhering Sheet: Minimum 19-mil- thick, self-adhering sheet consisting of air-barrier film and adhesive with release liner on adhesive side: Perm-A-Barrier NPS.

L. Elastomeric Flashing Sheet: ASTM D 2000, minimum 50- to 65-mil-thick, cured sheet neoprene with manufacturer-recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.

M. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

N. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 92 00 "Joint Sealants."

O. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
   3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   4. Verify that masonry joints are flush and completely filled with mortar.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
   1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip, adhesive-coated transition strip, or preformed silicone-sealant extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
1. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.
2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide strip as follows:
1. Counterflashing strip for metal flashings.
2. Modified bituminous strip for nonmetallic flashings.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
1. Apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one or more equal coats.

C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air-barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   4. Site conditions for application temperature and dryness of substrates have been maintained.
   5. Maximum exposure time of materials to UV deterioration has not been exceeded.
   6. Surfaces have been primed, if applicable.
   7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   8. Termination mastic has been applied on cut edges.
   9. Strips and transition strips have been firmly adhered to substrate.
   10. Compatible materials have been used.
   11. Transitions at changes in direction and structural support at gaps have been provided.
   12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   13. All penetrations have been sealed.

C. Tests: As determined by Owner's testing agency from among the following tests:
   1. Qualitative Air-Leakage Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
   2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.
   1. Standing seam metal roof panels shall be provided by pre-engineered metal building manufacturer and shall match metal roofing panels as specified in Section 13 34 19 “Metal Building Systems.”

B. Related Sections:
   1. Section 07 42 13.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.
   2. Section 07 72 53 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review structural loading limitations of all roof structure during and after roofing.
   6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
   7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   8. Review temporary protection requirements for metal panel systems during and after installation.
   9. Review procedures for repair of metal panels damaged after installation.
   10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

D. Calculations:
   1. Included calculations with registered engineer seal, verifying roof panel and attachment method resist wind pressure imposed on it pursuant to applicable building code.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof area and eave, including fascia, and soffit as shown on Drawings; approximately 48 inches square by full thickness, including attachments, underlayment, and accessories.
   2. Build mockups for typical roof area only, including accessories.
      a. Size: 12 feet long by 6 feet.
      b. Each type of exposed seam and seam termination.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

D. Special Installer Warranty: Furnish a written warranty signed by the panel applicator guaranteeing materials and workmanship for watertightness of the roofing system, flashings, penetrations, and against all leaks.
   1. Warranty Periord: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for steep-slope roof products.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Structural Drawings.
   2. Other Design Loads: As indicated on Structural Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 and ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 and ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. **15** lbf/sq. ft.

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 90.
   2. Fire/Windstorm Classification: Class 1A- 120.
   3. Hail Resistance: SH.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide products to match pre-engineered metal building manufacturer's standing seam metal roofing panels elsewhere on project. Refer to Section 13 34 19 "Metal Building Systems."
   2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
      a. Nominal Thickness: 0.028 inch.
      b. Exterior Finish: Two-coat fluoropolymer.
      c. Color: To match pre-engineered metal building manufacturer's standing seam metal roofing panels.
   3. Clips: Manufacturer's standard floating type to accommodate thermal movement.
      a. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
   4. Joint Type: Mechanically seamed, double folded.
   5. Panel Coverage: 16 inches, per pre-engineered metal building manufacturer's standing seam metal panel product details.
   6. Panel Height: 3 inches, per pre-engineered metal building manufacturer's standing seam metal panel product details.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Mid-States Asphalt Quick Stick HT Pro.
      b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
      c. Henry Company; Blueskin PE200 HT.
      d. Polyglass Polystick MTS
      e. Soprema Lastobond Shield HT.
      f. Tamko TW Underlayment or TW Metal & Tile Underlayment.

B. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felts.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot-long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
1. Insulate roof curb with 1-inch-thick, rigid insulation.

G. Panel Fasteners: Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, type and size as approved for the applicable loading requirements.

H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Joint Sealant: Silicone sealant, of type grade, class, and use classifications required to seal joints in metal panels and remain weather tight and accommodated calculated movement; and as recommended in writing by metal panel manufacturers.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.

2. Apply over the roof area indicated below:
   a. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
   b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
   c. Rake edges for a distance of 18 inches.
   d. Hips and ridges for a distance on each side of 12 inches.
   e. Roof-to-wall intersections for a distance from wall of 18 inches.
   f. Around dormers, and other penetrating elements for a distance from element of 18 inches.

B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.
1. Apply over the entire roof surface.
2. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches, in shingle fashion to shed water.

C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels (as directed/required by manufacturer).

D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

4. Watertight Installation:
   a. As determined by manufacturers as required to meet performance and warranty requirements of the Project.

F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

K. Roof Curbs: Install flashing around bases where they meet metal roof panels.

L. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 42 13.53 - METAL SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal soffit panels.
   1. Metal soffit panels shall be provided by pre-engineered metal building manufacturer and shall match factory-formed metal soffit panels as specified in Section 13 34 19 “Metal Building Systems.”

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof eave and soffit as shown on Drawings; approximately by full eave width, including attachments and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings.
   2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 2.86 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal soffit panels provided by pre-engineered metal building manufacturer elsewhere on project. Refer to Section 13 34 19 “Metal Building Systems.”
   1. Finish and Color: Match soffit panels provided by pre-engineered metal building manufacturer.
   2. Sealant: Factory applied within interlocking joint.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
   1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:
   1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
   2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 54 23 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Vapor retarder.
3. Air barrier.
4. Roof insulation.

B. Related Requirements:
1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 71 29 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies.
4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.

3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:
1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of roofing system.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carlisle SynTec Incorporated.
   2. Firestone Building Products.
   3. GAF Materials Corporation.
   4. Johns Manville.

B. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing, base flashings, and component materials shall comply with the following requirements:
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hail-Resistance Rating: VSH.

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low -slope roof products.

E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class C; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

G. Roof assembly shall provide a minimum of R-30 as a baseline, unless otherwise indicated on the Drawings. Tapered insulation shall be added above this minimum. Insulation at roof drains to be 5 inches.

2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
   1. Thickness: 60 mils, nominal.
   2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corporation; GlasRoc Sheathing Type X.
      b. Georgia-Pacific Corporation; Dens Deck or Dens Deck Prime.
      c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing or DEXcell Glass Mat Roof Board.
      d. USG Corporation; Securock Glass Mat Roof Board.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.6 VAPOR RETARDER

A. Laminated Sheet: Polyethylene laminate, two layers, reinforced with cord grid, with maximum permeance rating of 0.06 perm.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Reef Industries, Inc.
   2. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces. Use of Type II, Class I, Grade 2 insulation is not permitted.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products.
      c. GAF Materials Corporation.
      d. Hunter Panels.
      e. Insulfoam LLC; a Carlisle company.
      f. Johns Manville.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corporation; GlasRoc Sheathing.
      b. Georgia-Pacific Corporation; Dens Deck or Dens Deck Prime.
      c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing or DEXcell Glass Mat Roof Board.
      d. USG Corporation; Securock Glass Mat Roof Board.

2.9 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D 312, Type III or Type IV.

B. Asphalt Primer: ASTM D 41/D 41M.

2.10 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
   1. Color: Tan or Gray.

2.11 OTHER MATERIALS

A. Other materials not specifically described but required for a complete and proper installation of the Work in this Section shall be as selected by Contractor, approved by the manufacturer, and subject to approval by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed section of roofing system at the end of the workday or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
   2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 VAPOR-RETARDER INSTALLATION

A. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten first layer of insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
   2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   3. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
   1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.

3.7 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
   1. Electric Field Vector Mapping (EFVM): Testing agency shall survey entire roof area for potential leaks using electric field vector mapping (EFVM).

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manufactured through-wall flashing with snaplock receiver.
2. Formed low-slope roof sheet metal fabrications.
3. Formed steep-slope roof sheet metal fabrications.
4. Formed equipment support flashing.
5. Formed overhead-piping safety pans.

B. Related Requirements:
1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section < 07 41 13.16 “Standing Seam Metal Roof Panels” for installation of sheet metal flashing and trim integral with roofing.
3. Section 07 72 00 "Roof Accessories" for set-on-type curbs, roof hatches, vents, and other manufactured roof accessory units.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.
1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.

7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of roof edge flashing that is SPRI ES-1 tested.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
1. For d roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockup of typical roof, including fascia, fascia trim and apron flashing, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. FM Approvals Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.

D. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: As indicated on Structural Drawings.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
   1. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.

2. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
3. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
    a. Color: Match Architect's sample.
    b. Color Range: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
4. Exposed Coil-Coated Finish:
    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. Color: Match Architect's sample.
6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, **G90** coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:
    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: Match Architect's sample.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226**/**D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners**,** solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:
   1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½ inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cheney Flashing Company.
      b. Fry Reglet Corporation.
      c. Heckmann Building Products, Inc.
      d. Hickman Company, W. P.
      e. Hohmann & Barnard, Inc.
      f. Keystone Flashing Company, Inc.
      g. National Sheet Metal Systems, Inc.
      h. Sandell Manufacturing Co., Inc.
   2. Material: Aluminum, 0.024 inch thick.
   3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
   5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
   6. Accessories:
      a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
      b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

7. Finish: With manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

J. Do not use graphite pencils to mark metal surfaces.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials: Shop fabricate interior and exterior corners.
   1. Galvanized Steel: 0.034 inch thick.

B. Base Flashing: Fabricate from the following materials:
   1. Aluminum: 0.040 inch thick.
   2. Stainless Steel: 0.019 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

D. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch thick.

F. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.016 inch thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

B. Valley Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

C. Drip Edges: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

F. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
1. Stainless Steel: 0.016 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.
2. Stainless Steel: 0.016 inch thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:
1. Aluminum: 0.040 inch thick.
2. Stainless Steel: 0.019 inch thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:
   1. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

C. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
   5. Torch cutting of sheet metal flashing and trim is not permitted.
   6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
   1. Do not solder metallic-coated steel and aluminum sheet.
   2. Do not use torches for soldering.
   3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
   4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 20 00 "Unit Masonry."

C. Reglets: Installation of reglets is specified in Section 04 20 00 "Unit Masonry."

D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for downspout guards and downspout boots.
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 07 41 13.16 "Standing-Seam Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
4. Section 07 62 00 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
5. Section 07 71 29 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
6. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
7. Section 07 72 53 "Snow Guards" for manufactured snow guard devices.
8. Section 07 92 00 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.
1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification:
   1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
   2. Include copings, roof-edge specialties, roof-edge drainage systems, and reglets and counterflashings made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 07 54 23 "Thermoplastic Polyolefin (TPO) Roofing".

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
   1. Build mockup of typical roof edge as part of Integrated Exterior Mockup specified in Section 01 40 00 "Quality Requirements".
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 07 54 23 "Thermoplastic Polyolefin (TPO) Roofing".

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings and roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Pressure: As indicated on Structural Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Architectural Products Company.
      b. ATAS International, Inc.
      c. Castle Metal Products.
      d. Cheney Flashing Company.
      e. Hickman Company, W. P.
      f. Merchant & Evans, Inc.
      g. Metal-Era, Inc.
      h. Metal-Fab Manufacturing, LLC.
      i. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
      j. Petersen Aluminum Corporation.
   2. Extruded-Aluminum Coping Caps: Extruded aluminum, 0.125 inch thick.
      a. Finish: Three-coat fluoropolymer.

b. Color: As selected by Architect from manufacturer's full range.
3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
   a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.

2.3 ROOF-EDGE SPECIALTIES

A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of compression-clamped metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Architectural Products Company.
   b. ATAS International, Inc.
   c. Castle Metal Products.
   d. Cheney Flashing Company.
   e. Hickman Company, W. P.
   f. Merchant & Evans, Inc.
   g. Metal-Era, Inc.
   h. Metal-Fab Manufacturing, LLC.
   i. Petersen Aluminum Corporation.
2. Extruded-Aluminum Fascia Covers: Extruded aluminum, 0.125 inch thick.
   a. Finish: Three-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.
3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Fascia Accessories: Fascia extenders with continuous hold-down cleats,.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Architectural Products Company.
2. ATAS International, Inc.
3. Berger Building Products, Inc.
4. Castle Metal Products.
5. Cheney Flashing Company.
6. CopperCraft by FABRAL; a Euramax company.
7. Hickman Company, W. P.
8. Merchant & Evans, Inc.
9. Metal-Era, Inc.
10. Metal-Fab Manufacturing, LLC.
11. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Aluminum Sheet: 0.050 inch thick.
2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and continuously welded.
4. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.

5. Special Fabrications: Radiussed sections.
6. Gutter Accessories: Wire ball downspout strainer.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.050 inch thick.

D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim,.
1. Formed Aluminum: 0.032 inch thick.

E. Splash Pans: Fabricate from the following exposed metal:
1. Formed Aluminum: 0.040 inch thick.

F. Aluminum Finish: Two-coat fluoropolymer.
1. Color: As selected by Architect from manufacturer's full range.

2.5 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Castle Metal Products.
2. Cheney Flashing Company.
3. Fry Reglet Corporation.
4. Heckmann Building Products Inc.
5. Hickman Company, W. P.
6. Keystone Flashing Company, Inc.
7. Metal-Era, Inc.
8. Metal-Fab Manufacturing, LLC.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.022-inch thickness.
2. Corners: Factory mitered and soldered.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Multiuse Type, Embedded: For multiuse embedment in masonry mortar joints.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.022-inch thickness.

D. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
1. Color: As selected by Architect from manufacturer's full range.

2.6 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.7 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F.
   2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F.

B. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

2.8 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
   1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
   2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
   3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:
   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

E. Aluminum Extrusion Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
1. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers.

3.5 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
   1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
   1. Connect downspouts to underground drainage system indicated.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement.

E. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.7 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Section 04 20 00 "Unit Masonry" for installation of reglets.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

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SECTION 07 71 29 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bellows-type roof expansion joints.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
   2. Section 07 54 23 "Thermoplastic Polyolefin (TPO) Roofing" for roofing system.
   3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.
   4. Section 07 72 00 "Roof Accessories" for manufactured and prefabricated metal roof curbs.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof expansion joints.
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
   3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 BELLOWS-TYPE ROOF EXPANSION JOINTS

A. Source Limitations: Obtain bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.

B. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a 3- to 4-inch-wide metal flange for nailing to substrate. Provide each size and type indicated, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.
   1. Basis of Design: Subject to compliance with requirements, provide Watson Bowman Acme Corp. Wabo Flash EEJ/C – ECF/C Series or comparable products by one of the following:
      a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
      b. Balco, Inc.
      c. Building Materials Corporation of America; GAF Materials Corporation.
      d. C/S Group.
      e. InPro Corporation (IPC).
      f. Johns Manville; a Berkshire Hathaway company.
      g. MM Systems Corporation.
   2. Joint Movement Capability: Plus and minus 50 percent of joint size.
   3. Bellows: EPDM flexible membrane, nominal 60 mils thick.
      a. Color: Black.
   4. Flanges: Galvanized steel, 0.022 inch thick.
      a. Form: Angle formed to fit curbs as indicated on Drawings.
   5. Cover Membrane: EPDM flexible membrane, factory laminated to bellows and covering entire joint assembly and curbs.
      a. Color: Black.

2.3 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90.

B. EPDM Membrane: ASTM D 4637, Type standard with manufacturer for application.

C. Adhesives: As recommended by roof-expansion-joint manufacturer.

D. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine roof-joint openings, inside surfaces of parapets, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.
   1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
   2. Install roof expansion joints true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   3. Provide for linear thermal expansion of roof expansion joint materials.
   4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
   5. Provide uniform, neat seams.
   6. Install roof expansion joints to fit substrates and to result in watertight performance.
   7. Torch cutting of roof expansion joints is not permitted.
   8. Do not use graphite pencils to mark aluminum surfaces.

B. Directional Changes and Other Expansion-Control Joint Systems: Coordinate installation of roof expansion joints with other expansion-control joint systems to result in watertight performance. Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.

C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.
   1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

3.3 PROTECTION

A. Protect roof expansion joints from foot traffic, displacement, or other damage.

B. Remove and replace roof expansion joints and components that become damaged by moisture or otherwise.

END OF SECTION

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof hatches.
      a. Size:3’-0” x 3’-0”.

B. Related Sections:
   1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders for access to roof hatches.
   2. Section 05 52 13 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
   3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   4. Section 07 71 00 "Roof Specialties" for manufactured fasciae, copings, gutters and downspouts, and counterflashing.

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company (The); TYPE E LADDER ACCESS or a comparable product by one of the following:
      a. Babcock-Davis.
      b. Dur-Red Products.
      c. JL Industries, Inc.; a division of the Activar Construction Products Group.
      d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      e. Nystrom, Inc.
      f. O'Keeffe's Inc.
      g. Precision Ladders, LLC.

B. Type and Size: Single-leaf lid, 36 by 36 inches.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet.
   1. Thickness: 11 gauge.
   2. Finish: Mill finish.

E. Construction:
   1. Insulation: Cellulosic-fiber board or Glass-fiber board.
   2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
   6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, galvanized or stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
   1. Height: 42 inches above finished roof deck.

2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard .
    a. Color: As selected by Architect from manufacturer's full range.

2.3 METAL MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

C. Steel Tube: ASTM A 500**/**A 500M, square tube.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F thickness as indicated.

D. Wood Nailers: Softwood lumber, pressure treated according to Section 06 10 53 “Miscellaneous Rough Carpentry” and complying with AWPA C2; not less than 1-1/2 inches thick.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187**/**D 1187M.

F. Underlayment:
1. Felt: ASTM D 226**/**D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Slip Sheet: Building paper, 3 lb./100 sq. ft. minimum, rosin sized.
3. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
4. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:
1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.

D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Clean off excess sealants.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 72 53 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pad-type, flat-mounted snow guards.
2. Pad-type, seam-mounted snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
1. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.

C. Samples: Full-size unit.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Structural Performance:
1. Snow Loads: As indicated on Drawings.

2.2 PAD-TYPE SNOW GUARDS

A. Flat-Mounted and Seam-Mounted Metal Snow Guard Pads:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Alpine SnowGuards; a division of Vermont Slate & Copper Services, Inc.
b. Berger Building Products.
c. PMC Industries, Inc.
d. Roofers Edge.
e. Sieger Snow Guards Inc.
f. Sno-Gem, Inc.
g. SnoGuard.
h. TRA-MAGE, Inc.
i. Zaleski Snow-Guards for Roofs, Inc.
2. Material: Manufacturer's standard noncorrosive metal.

3. Finish and Color: Powder coat; color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
   1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Clean and prepare substrates for bonding snow guards.

B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.

B. Attachment for Standing-Seam Metal Roofing:
   1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
   2. Seam-Mounted Metal Snow Guard Pads: Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

END OF SECTION

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.

B. Related Requirements:
   1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
         2) Intertek Group in its "Directory of Listed Building Products."
         3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Basis of Design: Hilti; “FS-One High Performance Intumescent Firestop” or comparable products by one of the following manufacturers:
      a. 3M Fire Protection Products.
      b. A/D Fire Protection Systems Inc.
      c. Grabber Construction Products.
      d. Hilti, Inc.
      e. HOLDRITE.
      f. NUCO Inc.
      g. Passive Fire Protection Partners.
      h. RectorSeal.
      i. Specified Technologies, Inc.
      j. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Steel sleeves.

2.3 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inchstrokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."

END OF SECTION

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.

B. Related Requirements:
1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
         2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. A/D Fire Protection Systems Inc.
      c. Blazeframe Industries.
      d. Grabber Construction Products.
      e. Hilti, Inc.
      f. Metal-Lite.
      g. Nelson Firestop; a brand of Emerson Industrial Automation.
      h. NUCO Inc.
      i. Passive Fire Protection Partners.
      j. RectorSeal.
      k. Roxul Inc.
      l. Specified Technologies, Inc.
      m. Thermafiber, Inc.; an Owens Corning company.
      n. Tremco, Inc.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, or roof in or between which it is installed.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Industrial Insulation Group, LLC (IIG-LLC).
      d. Nelson Firestop; a brand of Emerson Industrial Automation.
      e. NUCO Inc.
      f. RectorSeal.
      g. Roxul Inc.
      h. Specified Technologies, Inc.
      i. Thermafiber, Inc.; an Owens Corning company.
      j. Tremco, Inc.

2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing joint firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inchstrokes.
   1. Locate in accessible concealed attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.
6. Polyurea joint sealants.

B. Related Requirements:
1. Section 03 35 43 “Polished Concrete Finishing” for joint filling requirements.
2. Section 08 80 00 “Glazing" for glazing sealants used and accessories.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

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

B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each kind of sealant and joint substrate.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2700 SilPruf LM.
      b. Sika Corporation; Sikasil WS-290.

B. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 758.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2350.
      c. Polymeric Systems, Inc; PSI-631.
      d. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
      e. Sherwin-Williams Company (The); White Lightning Silicone Ultra All Purpose Sealant.
      f. Sika Corp; SikaSil-N Plus.

C. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Bostik, Inc; Chem-Calk 1200.
      b. Dow Corning Corporation; 999A.
      c. Pecora Corporation; 860.
      d. Polymeric Systems, Inc; PSI-601.
      e. Tremco; Tremsil 200.
      f. Sika Corporation; Sikasil-GP.

D. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Sika Corp; SikaSil 200.

E. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade P, Class 100/50, Uses T and NT.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Sika Corp; SikaSil 728 RCS.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corporation; 890 NST.
      b. Sika Corp; SikaSil WS-290, SikaSil WS-290 FPS.
      c. Tremco Incorporated; Spectrem 3.

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 756 SMS.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf NB.
      c. Pecora Corporation; 864NST.
      d. Sika Corp; SikaSil WS- 295, SikaSil WS-295 FPS
      e. Tremco Incorporated; Spectrem 2.

2.4 POLYUREA JOINT SEALANTS

A. Polyurea, semi-rigid. Two-part, 100% solids, rapid setting polyurea polymer liquid system. For use in conjunction with control joints in polished concrete, allowing joint to be ground/polished with the concrete in interior applications. Shore hardness, Shore A @ 70 deg F, method D-2240-result minimum 75. Suitable for moderate traffic.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Metzger/Mcquire – Edge-Pro 80.
      b. VersaFlex Incorporated: VersaFlex 75.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 786-M White.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
      c. Soudal USA; RTV GP.

d. Sika Corp; SikaSil N Plus
e. Tremco Incorporated; Tremsil 200.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Pecora Corporation, BC-158.
b. Tremco Incorporated, Butyl Sealant.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Construction Chemicals - Construction Systems; Sonolac.
b. Pecora Corporation; AC-20.
c. Sherwin-Williams Company (The); 850A Siliconized Acrylic Latex Caulk.
d. Tremco Incorporated; Tremflex 834.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish systems.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
   b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Joints between plant-precast architectural concrete paving units.
      c. Tile control and expansion joints.
      d. Joints between different materials listed above.
      e. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, M, P, 100/50, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints in dimension stone cladding.
      d. Joints in exterior insulation and finish systems.
      e. Joints between metal panels.
      f. Joints between different materials listed above.
      g. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      h. Control and expansion joints in ceilings and other overhead surfaces.
      i. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, S, P, 25, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Tile control and expansion joints.
      c. Vertical joints on exposed surfaces of unit masonry, concrete walls partitions.
      d. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, S, NS, 25, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

c. Other joints as indicated on Drawings.
2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

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SECTION 07 95 00 - EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior and interior wall expansion control systems.

B. Related Requirements:
   1. Section 07 71 29 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion control.
   2. Section 07 84 43 "Joint Firestopping" for liquid-applied joint sealants in fire-resistive building joints.
   3. Section 07 92 00 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.2 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system.

B. Samples for Initial Selection: For each type of expansion control system indicated.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

C. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.

D. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion control system.
   2. Expansion control system location cross-referenced to Drawings.
   3. Nominal joint width.
   4. Movement capability.
   5. Classification as thermal or seismic.
   6. Materials, colors, and finishes.
   7. Product options.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.

2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Component Importance Factor is 1.0.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated or comparable product by one of the following:
   1. Balco, Inc.
   2. InPro Corporation (IPC).
   3. MM Systems Corporation.
   4. Watson Bowman Acme Corp.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
   1. Basis-of-Design Product: Emseal Joint Systems, Ltd.; Seismic Colorseal.
   2. Description: Watertight, energy-efficient exterior and interior joints in vertical-plane walls (above-grade) and with silicone-coated sealing face provided in one integrated primary system.
      a. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
   3. Design Criteria:
      a. Nominal Joint Width: As indicated on Drawings.
      b. Minimum Joint Width: As indicated on Drawings.
      c. Maximum Joint Width: As indicated on Drawings.
      d. Movement Capability: -50 percent / +50 percent.
      e. Type of Movement: Seismic.
   4. Type: Cover plate at interior side of wall.
      a. Metal: Aluminum.
         1) Finish: Color anodic, Class I, color as selected by Architect.
      b. Interior Seal Material: Manufacturer's standard.
         1) Color: Gray.
   5. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with manufacturer’s installation instructions.

2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated or comparable product by one of the following:
   1. Balco, Inc.
   2. InPro Corporation (IPC).

3. MM Systems Corporation.
4. Watson Bowman Acme Corp.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
1. Basis-of-Design Product Emseal Joint Systems, Ltd.; Seismic Colorseal.
2. Description: Watertight, energy-efficient exterior and interior joints in vertical-plane walls (above-grade) and with silicone-coated sealing face provided in one integrated primary system.
   a. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
3. Design Criteria:
   a. Nominal Joint Width: As indicated on Drawings.
   b. Minimum Joint Width: As indicated on Drawings.
   c. Maximum Joint Width: As indicated on Drawings.
   d. Movement Capability: -50 percent / +50 percent.
   e. Type of Movement: Thermal and seismic.
4. Type: Factory-applied silicone on preformed cellular foam. Silicone coating is exposed at exterior side of wall.
   a. Foam Material: Manufacturer's standard.
   b. Color of silicone coating: As selected by Architect from manufacturer's full range to match adjacent building wall finishes.
      1) Where building wall finishes change in color in the vertical plane, exposed silicone coating shall also change in color to match adjacent wall finish.
5. Terminations into horizontal plane surfaces to be provided through field fabrication in strict accordance with manufacturer's installation instructions.

2.5 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
1. Multiple silicone external color facings to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coatings. Exterior silicone coatings to be available in a range of not less than 26 standard colors for coordination with typical building materials.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish: Color anodic, Class I, color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Foam Seals: Install with adhesive recommended by manufacturer.

C. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:
1. Section 04 “Unit Masonry” For building anchors into and grouting hollow metal frames in masonry construction.
2. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
3. Section 09 91 23 "Interior Painting" and Section 09 96 00 “High Performance Coatings” for door and frame finish coatings.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:
1. Elevations of each door type.
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 each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Amweld International, LLC.
   2. Ceco Door, ASSA ABLOY.
   3. Curries Company; ASSA ABLOY.
   4. Mesker Door Inc.
   5. Pioneer Industries, Inc., ASSA ABLOY.
   6. Republic Doors and Frames.
   7. Steelcraft; an Allegion brand.

2.2 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At interior locations, unless otherwise indicated.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Cold-rolled steel sheet, minimum thickness of 0.053 inch.
      d. Edge Construction: Model 2, Seamless.
      e. Core: Vertical steel stiffener.
   3. Frames:
      a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.053 inch.
      b. Construction: Full profile welded.
   4. Exposed Finish: Prime.

C. Maximum-Duty Doors and Frames: SDI A250.8, Level 4. At interior Service Level locations, and other locations where indicated.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches
      c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
      d. Edge Construction: Model 2, Seamless.

e. Core: Vertical steel stiffener.

3. Frames:
   a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.067 inch.
   b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard polyurethane, polyisocyanurate, or mineral-board core at manufacturer's discretion.
      1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
3. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
   b. Construction: Full profile welded.
   c. Thermal properties: Minimum of 0.41 U value (2.4 R value) according to NFRC 102-2014 and ASTM.
      1) Provide thermal barrier anchor applications.
4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

B. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

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

2.6 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 metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
   3. Top Edge Closures: Close top edges of doors with inverted or flush closures, except provide flush closures at exterior doors, of same material as face sheets.
   4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
   5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   6. Astragals: Provide overlapping astragal on one leaf of pairs of where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. 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.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor.

5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      1) Three anchors per jamb up to 90 inches high.
      2) Four anchors per jamb from 90 to 120 inches high.
      3) Four anchors per jamb plus one 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) Four anchors per jamb upto 90 inches high.
      2) Five anchors per jamb from 90 to 96 inches high.
      3) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, templates, and the following:
1. Reinforcement:
   a. Hinge Reinforcement: Metallic-coated steel sheet, minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   b. Other Surface-Mounted Hardware, Lock Face, Flush Bolts, Closers, and Concealed Holders: Metallic-coated steel sheet, minimum 0.067 inch thick.
2. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
3. Provide welded continuous 12 gauge straps in doors and frames for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
4. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      b. Install frames with removable stops located on secure side of opening.
      c. Install door silencers in frames before grouting.
      d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
      a. Provide at walls with STC ratings over 52.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   6. In-Place Metal-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
   7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door (No Threshold): 3/4 inch plus or minus 1/32 inch.
d. Between Bottom of Door And Threshold: 3/8 inch plus or minus 1/32 inch.
e. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
   1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Undercuts.
   5. Requirements for veneer matching.
   6. Doors to be factory finished and finish requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish**.** For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
   2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
      a. Provide Samples for each species of veneer and solid lumber required.
      b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
   3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eggers Industries.
   2. Marshfield-Algoma Division, Masonite International Corporation.
   3. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
   1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. Structural-Composite-Lumber-Core Doors:
   1. Structural Composite Lumber: WDMA I.S.10.
      a. Screw Withdrawal, Face: 700 lbf.
      b. Screw Withdrawal, Edge: 400 lbf.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Grade: Premium, with Grade AA faces.
   2. Species: White oak or other species as selected by Architect.
   3. Cut: Rift cut.
   4. Match between Veneer Leaves: Book match.

5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
8. Transom Match: Continuous match.
9. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
10. Core: Structural composite lumber.
11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Flush rectangular beads.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
   3. Staining: Clear finish.
   4. Effect: Open-grain finish.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 14 33 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior stile and rail wood doors.
2. Finishing stile and rail wood doors.
3. Fitting stile and rail wood doors to frames and machining for hardware.
4. Prehanging doors in frames.

B. Related Requirements:
1. Section 09 93 00 "Staining and Transparent Finishing" for field finishing stile and rail doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include details of construction.
2. Include factory-finishing specifications.

B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data , including the following:
1. Dimensions of doors for factory fitting.
2. Locations and dimensions of mortises and holes for hardware.
3. Undercuts.
4. Requirements for veneer matching.
5. Doors to be factory finished and finish requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish Sample with same materials proposed for factory-finished doors.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of door, from manufacturer.

B. Sample Warranty: For special warranty.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, within specified warranty period.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
      a. Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain stile and rail wood doors from single manufacturer.

2.2 MATERIALS

A. General: Use only materials that comply with referenced standards and other requirements specified.
   1. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. Panel Products: Any of the following unless otherwise indicated:
   1. Particleboard made from wood particles, with binder containing no urea-formaldehyde, complying with ANSI A208.1, Grade M-2.
   2. Particleboard made from straw, complying with ANSI A208.1, Grade M-2, except for density.
   3. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde, complying with ANSI A208.2, Grade 130.
   4. Hardboard complying with ANSI A135.4.
   5. Veneer-core plywood, made with adhesive containing no urea-formaldehyde.

D. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.3 INTERIOR STILE AND RAIL WOOD DOORS

A. Interior Stile and Rail Wood Doors: Interior custom doors complying with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards," and with other requirements specified.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Artistic Doors and Windows, Inc.
      b. Belentry Doors LLC.
      c. Dimension Millworks.

d. Eggers Industries.
e. Enjo Architectural Millwork.
f. Harring Doors.
g. Marshfield-Algoma Division, Masonite International Corporation.
h. Pinecrest Inc.
i. Select Door.
j. Sun-Dor-Co.
k. Woodtech Trading Company.

2. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
3. Grade: Premium.
4. Finish: Transparent.
5. Wood Species and Cut for Transparent Finish: White Oak, plain sawed/sliced, or other species as selected by Architect.
6. Door Construction for Transparent Finish:
   a. Stile and Rail Construction: Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
   b. Flat-Panel Construction: Veneered, wood-based panel product.
7. Stile and Rail Widths: Manufacturer's standard, but not less than the following:
   a. Stiles, Top and Intermediate Rails: 4-1/2 inches.
   b. Bottom Rails: 9 inches.
8. Flat-Panel Thickness: 1/2 inch.
9. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

2.4 STILE AND RAIL WOOD DOOR FABRICATION

A. Fabricate stile and rail wood doors in sizes indicated for field fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.5 SHOP PRIMING

A. Doors for Transparent Finish: Shop prime faces and all four edges with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 93 00 "Staining and Transparent Finishing." Seal edges of cutouts and mortises with first coat of finish.

2.6 FINISHING

A. Finish wood doors at factory that are indicated to receive transparent finish.

B. For doors indicated to be factory finished, comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards," and with other requirements specified.
   1. Finish faces and all four edges of doors, including mortises and cutouts. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
   3. Staining: Clear finish, as selected by Architect from manufacturer's full range.
   4. Effect: Open-grain finish.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory -Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames for walls and ceilings.

B. Related Requirements:
   1. Section 07 72 00 "Roof Accessories" for roof hatches.
   2. Section 23 33 00 " Duct Access" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details materials, individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alfab, Inc.
   2. Babcock-Davis.
   3. Jensen Industries; Div. of Broan-Nutone, LLC.
   4. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   5. Karp Associates, Inc.
   6. Larsen's Manufacturing Company.
   7. Maxam Metal Products Limited.
   8. Metropolitan Door Industries Corp.
   9. MIFAB, Inc.
   10. Milcor Inc.
   11. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:
   1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   2. Locations: Wall.
   3. Door Size: 18” x 18” minimum at stud walls, 16” x 16” at CMU walls.

4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage.
   a. Finish: Factory prime. Paint to match adjacent wall finish.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Piano.
7. Hardware: Lock.

D. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Door Size: 18” x 18” minimum at stud walls, 16” x 16” at CMU walls, 24” x 24” at ceilings.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage.
   a. Finish: Factory prime. Paint to match adjacent wall or ceiling finish.
5. Frame Material: Same material and thickness as door.
6. Hinges: Piano.
7. Hardware: Lock.

E. Medium-Security Flush Access Doors:
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Door Size: 18” x 18” minimum at stud walls, 16” x 16” at CMU walls, 24” x 24” at ceilings.
4. Stainless-Steel Sheet for Door: Nominal 0.078 inch, 14 gage.
   a. Finish: No. 4.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard security hinge.
7. Hardware: Tamper-resistant lock.

F. Hardware:
1. Lock: Cylinder.
   a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00 "Door Hardware."

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

F. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
   2. Provide mounting holes in frames for attachment of units to metal framing.
   3. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:
   1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
   2. Paint to match adjacent wall or ceiling finish.

E. Stainless-Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      a. Run grain of directional finishes with long dimension of each piece.
      b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
      c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 33 13 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Counter doors.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
   1. Curtain slats.
   2. Bottom bar.
   3. Guides.
   4. Brackets.
   5. Hood.
   6. Locking device(s).
   7. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.
   1. Obtain operators and controls from coiling counter door manufacturer.

2.2 COUNTER DOOR ASSEMBLY

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. CHI Overhead.
      b. Cookson Company.
      c. Cornell Iron Works, Inc.
      d. McKeon Rolling Steel Door Company, Inc.
      e. Overhead Door Corporation.
      f. Raynor.
      g. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Stainless steel.

E. Door Curtain Slats: Flat profile slats of 1-1/4-inch center-to-center height.
   1. Insulated-Slat Interior Facing: Metal.
   2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

F. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.

G. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

H. Hood: Match curtain material and finish.
   1. Shape: Square.
   2. Mounting: Face of wall.

I. Integral Frame, Hood, and Fascia: Stainless steel.
   1. Mounting: Face of wall or between jambs as shown on Drawings.

J. Sill Configuration: No sill.

K. Locking Devices: Equip door with slide bolt for padlock.
   1. Locking Slide Bolt Assembly: Interior slide bolts at both ends of bottom bar.

L. Manual Door Operator: Manufacturer's standard crank operator.
   1. Provide operator with manufacturer's standard removable operating arm.

M. Door Finish:
   1. Stainless-Steel Finish: No. 4 (polished directional satin).
   2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch; and as required.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.4 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Stainless Steel: 0.025-inch-thick stainless-steel sheet, Type 304, complying with ASTM A 666.

B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
   1. Stainless Steel: Type 304, complying with ASTM A 666.

2.5 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks at ends of bottom bar to lock, located on both left and right jamb sides, operable from interior side.

B. Locking Device Assembly: Adjustable locking bars to engage through slots in tracks, suitable for locking by padlock.

2.6 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

C. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25-lbf force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
1. Perform installation and startup checks according to manufacturer's written instructions.

2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance, during normal working hours.
   2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION

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SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes electrically operated sectional doors.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
2. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for finish painting of factory-primed steel doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.
1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied finishes.
1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
1. Flat door sections.
2. Frame for paneled door sections; of each width of stile and rail required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Failure of components or operators before reaching required number of operation cycles.
      c. Faulty operation of hardware.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
      e. Delamination of exterior or interior facing materials.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
   1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: As indicated on Structural Drawings.
   2. Testing: According to ASTM E 330.
   3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
      a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
      b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.

C. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Component Importance Factor: 1.0.

2.3 DOOR ASSEMBLY TYPE 1

A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. C.H.I. Overhead Doors.
      b. Clopay Building Products.
      c. Harmann LLC.
      d. Overhead Door Corporation.
      e. Raynor.
      f. Rite-Hite Corporation.
      g. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.

D. Installed R-Value: 17.5 deg F x h x sq. ft./Btu.

E. Steel Sections: Zinc-coated (galvanized) steel sheet with G90 zinc coating.
   1. Section Thickness: 2 inches.
   2. Exterior-Face, Steel Sheet Thickness: 0.022-inch- nominal coated thickness.
      a. Surface: Flat.
   3. Insulation: Foamed in place.
   4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of manufacturer's recommended dimension to comply with performance requirements.

F. Track Configuration: Standard-lift or vertical-lift as indicated track.

G. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.

H. Roller-Tire Material: Neoprene or bronze.

I. Counterbalance Type: Torsion spring.

J. Electric Door Operator:
   1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
   2. Operator Type: Jackshaft, side mounted.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
   4. Motor Exposure: Interior, clean, and dry.
   5. Emergency Manual Operation: Chain type.
   6. Obstruction-Detection Device: Automatic photoelectric sensor.
   7. Control Station: Interior-side mounted and exterior-side mounted.

K. Door Finish:
   1. Factory Prime Finish: Manufacturer's standard color.
   2. Finish of Interior Facing Material: Match finish of exterior section face.

2.4 DOOR ASSEMBLY TYPE 2

A. Glass Panel Aluminum Sectional Door: Sectional door formed with hinged glazed aluminum panel sections and fabricated according to DASMA 102 unless otherwise indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Clopay Building Products, Architectural Series, Model 903; or comparable product by one of the following:
      a. C.H.I. Overhead Doors.
      b. Harmann LLC.
      c. Overhead Door Corporation.
      d. Raynor.
      e. Renlita Custom Opening Solutions.
      f. Rite-Hite Corporation.
      g. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.

D. Door Construction:
   1. Panel Sections: 2-1/8 inches (54 mm) thick extruded 6053-T5 aluminum, with integral reinforcing fin.
   2. Enclosed top and bottom rails 3-1/2 inches (89 mm) wide, meeting rails 2-13/16 inch (71.4 mm) wide, and end stiles 3-1/2 inches (89 mm) wide, with meeting rails meeting to form a tongue-and-groove joint with integral joint seal.
   3. Bottom rail configured to retain U-shaped flexible PVC astragal.
   4. Glazing panels installed and sealed with butyl tape and locking retainer.

E. Reinforcing fin included on doors wider than 14'. Doors 12' and under do not use built-in reinforcing fin. Usage on widths 12'-2" to 14' depend upon glass weight.

F. Track Configuration: Standard-lift or low-headroom track as indicated.

G. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.

H. Windows: Full-view aluminum sections; installed with glazing of the following type:
   1. Insulating Glass: Manufacturer's standard, 1/2 inch (13 mm) insulated tempered glass glazing.
   2. Gray tinted glass to match adjacent storefront. Refer to Section 08 80 00 "Glazing."

I. Roller-Tire Material: Manufacturer's standard.

J. Counterbalance Type: Torsion spring counterbalance mechanism sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of die cast aluminum with high strength galvanized aircraft cable with minimum 7 to 1 safety factor.

K. Electric Door Operator:
   1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
   2. Operator Type: Manufacturer's standard for door requirements.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
   4. Motor Exposure: Interior, clean, and dry.
   5. Emergency Manual Operation: Chain type.
   6. Obstruction-Detection Device: Automatic photoelectric sensor.
   7. Control Station: Interior-side mounted and exterior-side mounted.

L. Door Finish:
   1. Baked-Enamel or Powder-Coat Finish: Dark bronze color with gloss matching Architect's sample.
   2. Finish of Interior Facing Material: Match finish of exterior section face.

2.5 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 STEEL DOOR SECTIONS

A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
   1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
   2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.

B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch-nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.

C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.

D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.

E. Provide reinforcement for hardware attachment.

F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.

G. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.

H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.7 ALUMINUM DOOR SECTIONS

A. Sections: Extruded-aluminum stile and rail members with dimensions and profiles as indicated on Drawings; members joined by welding or with concealed, 1/4-inch-minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section; and with meeting rails shaped to provide a weather-resistant seal.
   1. Aluminum: ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; minimum thickness 0.065 inch for door section 1-3/4 inches deep, and as required to comply with requirements.
   2. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
   3. Provide reinforcement for hardware attachment.

B. Solid Panels: Aluminum sheet, complying with ASTM B 209, alloy and temper standard with manufacturer for type of use and finish indicated, not less than 0.040 inch thick, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.

C. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

2.8 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
   1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 zinc coating.

2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
   a. For Vertical Track: Intermittent, jamb brackets attached to track and attached to wall.
   b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.9 HARDWARE

A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch-nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.

D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.10 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.

C. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.

D. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.

E. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

F. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

G. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.11 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
   1. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
   2. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
   4. Use adjustable motor-mounting bases for belt-driven operators.

E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
   1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
   1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.12 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

2.14 STEEL AND GALVANIZED-STEEL FINISHES

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:
1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.

2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

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SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior and interior storefront framing.
2. Exterior and interior manual-swing entrance doors and door-frame units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Shop drawings and design must be done by the Aluminum Framing Manufacturer, not an outside or third party source, including storefront and doors, as a complete submittal. For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and field testing agency.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
   1. Submit engineering calculations confirming compliance with Article 2.1.C below and structural code requirements.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

D. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.7 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts. Engineer must be licensed in the State of Oklahoma.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

E. Structural: Test according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
   2. Entrance Doors:
      a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
      b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.24 Btu/sq. ft. x h x deg F as determined according to AAMA Specification 1503.
   2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.30 as determined according to NFRC 200.
   3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 66 for framing and 60 for glazing as determined according to AAMA Specification 1503.

J. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
   1. Outdoor-Indoor Transmission Class: Minimum 34.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

L. Structural-Sealant Joints:
   1. Designed to carry gravity loads of glazing.
   2. Designed to produce tensile or shear stress of less than 20 psi.

M. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
   1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.

2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 STOREFRONT SYSTEM (EXTERIOR)

A. Basis-of-Design Product: At exterior locations, and subject to compliance with requirements, provide Kawneer North America; Trifab VersaGlaze VG 451T, front set, with Heavy Wall Entrances or comparable products by one of the following:
   1. EFCO Corporation; 403.
   2. Oldcastle Building Envelope.
   3. Tubelite.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
   3. Glazing Plane: Front.
   4. Finish: Color anodic finish.
   5. Fabrication Method: Field-fabricated stick system.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

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

E. Materials:
   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      a. Sheet and Plate: ASTM B 209.
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
      c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      d. Structural Profiles: ASTM B 308/B 308M.
   2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
      a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
      b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
      c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 STOREFRONT SYSTEM (INTERIOR)

A. Basis-of-Design Product: At interior locations, and subject to compliance with requirements, provide Kawneer North America; Trifab VersaGlaze 450 with Heavy Wall Entrances or comparable products by one of the following:
   1. EFCO Corporation.
   2. Oldcastle Building Envelope.
   3. Tubelite.

B. Framing:
1. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
a. Glazing System: Retained mechanically with gaskets on four sides.
b. Glazing Plane: Center.
c. Finish: Color anodic finish to match exterior storefront system.
d. Fabrication Method: Field-fabricated stick system.
2. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
3. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
4. Materials:
a. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1) Sheet and Plate: ASTM B 209.
2) Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3) Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
4) Structural Profiles: ASTM B 308/B 308M.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's heavy duty glazed entrance doors for manual-swing operation.
1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width.
a. Bottom Rail: 10 inches high.
b. Top Rail: 6-1/2 inches high.
c. Cross rail at push rails.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Comply with Section 08 71 00 "Door Hardware."

2.7 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

E. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
1. Color: Black.

F. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
   1. Color: Match structural sealant.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: Dark bronze.

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 08 80 00 "Glazing."

G. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

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

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      a. Perform a minimum of two tests in areas as directed by Architect.

C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
   1. Test a minimum of two areas on each building facade.
   2. Repair installation areas damaged by testing.

D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

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SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazed aluminum curtain walls.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Shop drawings and design must be supplied by the Curtainwall Framing Manufacturer, not an outside or third party source, including storefront, doors, and curtainwall framing system as a complete submittal. For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inchlengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

E. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and field testing agency.

B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency.
   1. Submit engineering calculations confirming compliance with Article 2.1.C below and structural code requirements.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

D. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of curtain wall assemblies.

1.7 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls. Engineer must be licensed in the State of Oklahoma.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch whichever is smaller.
      a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural: Test according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..

H. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.24 Btu/sq. ft. x h x deg F as determined according to AAMA Specification 1503.
   2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.30 as determined according to NFRC 200.
   3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 75 for framing and 71 for glazing as determined according to AAMA Specification 1503.

J. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows:
   1. Outdoor-Indoor Transmission Class: Minimum 34.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

L. Structural-Sealant Joints:
   1. Designed to carry gravity loads of glazing.
   2. Designed to produce tensile or shear stress of less than 20 psi

M. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
   1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
   2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Alcoa company; 1620-UT, 2” x 6”; or a comparable product by one of the following:
   1. EFCO Corporation; 5900.
   2. Tubelite Inc.
   3. Wausau Window and Wall Systems; Apogee Wausau Group.
   4. YKK AP America Inc.
   5. Oldcastle.

B. Source Limitations: Obtain all components of curtain wall system, including framing, and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
      a. Coordinate thickness of security glazing installed to determine proper glazing channel size.
   3. Glazing Plane: Front.
   4. Finish: Color anodic finish.
   5. Fabrication Method: Either factory- or field-fabricated system.

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
   1. Include snap-on aluminum trim that conceals fasteners.

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

D. Materials:
   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      a. Sheet and Plate: ASTM B 209
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221
      c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      d. Structural Profiles: ASTM B 308/B 308M.
   2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
      a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
      b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
      c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCES

A. Entrances: Comply with Section 08 41 13 "Aluminum-Framed Entrances and Storefronts."

2.5 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: Silicone sealant as recommended by manufacturer.

D. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
   1. Color: Black.

E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
   1. Color: Match structural sealant.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-milthickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   7. Components curved to indicated radii.

D. Fabricate components to resist water penetration as follows:
   1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:
1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
3. Preparation includes, but is not limited to, cleaning and priming surfaces.
4. Seal joints watertight unless otherwise indicated.
5. Install glazing to comply with requirements in Section 08 80 00 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, or thicker.
1. Color: Dark bronze.

2.9 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 80 00 "Glazing."
   1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

F. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet 1/4 inch in 40 feet
   2. Level: 1/8 inch in 20 feet 1/4 inch in 40 feet
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch
   4. Location: Limit variation from plane to 1/8 inch in 12 feet 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

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

B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      a. Perform a minimum of three tests in areas as directed by Architect.

D. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
   1. Test a minimum of two areas.
   2. Repair installation areas damaged by testing.

E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

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SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of aluminum-framed windows:
   1. Fixed windows.
   2. Double hung windows.

B. Related Sections include the following:
   1. Section 08 41 13 "Aluminum Framed Entrances and Storefronts."
   2. Section 08 80 00 "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

1.2 DEFINITIONS

A. AW: Architectural.

B. HC: Heavy Commercial.

C. Performance grade number, included as part of the AAMA/NWWDA product designation code, is actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.

D. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

E. Minimum test size is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
   1. Minimum size required by AAMA/NWWDA 101/I.S.2.

B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.
   1. Performance Class: AW.
   2. Performance Grade: 50.

C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated:
   1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on structural computations.
   2. Basic Wind Speed: As indicated in miles per hour (meters per second) at 33 feet (10 m) above grade. Determine wind loads and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:
      a. ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 6.4.2, "Analytic Procedure."

D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
   1. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa).
   2. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).

E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
   1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa).
   2. Test Pressure: 20 percent of positive design pressure, but not more than 12 lbf/sq. ft. (580 Pa).

F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45, where windows are indicated to be "thermally improved."

G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
   1. U-Value: 0.35 Btu/sq. ft. x h x deg F (W/sq. m x K).

H. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum of 0.30, determined according to NFRC 200 procedures.

I. Sound Transmission Class: Provide glazed windows rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

J. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other Work, operational clearances, and the following:
   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Thermal-break details.
   6. Glazing details.
   7. Window cleaning provisions.
   8. Window System Operators: Show locations, mounting, and details for installing operator components and controls.

9. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
    a. Structural test pressures and design pressures from basic wind speeds indicated.
    b. Deflection limitations of glass framing systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For aluminum window components required, prepared on Samples of size indicated below.
1. Main Framing Member: 12-inch- (300-mm-) long, full-size sections of extrusions with factory-applied color finish.
2. Hardware: Full-size units with factory-applied finish.
3. Architect reserves the
4. right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Manufacturer and Installer.

B. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

C. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of down-sized test units will not be accepted.

D. Sample Warranties: For Manufacturer’s warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Provide AAMA-certified aluminum windows with an attached label.

E. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

F. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. Build mockup in building envelope wall in locations shown on Drawings.
2. Perform tests specified in "Field Quality Control" Article. Modify mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.
2. Warranty Period:
a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Window Types: Fixed Windows.
1. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. All Seasons Commercial Division, Inc.
b. EFCO Corporation.

c. EXTECH/Exterior Technologies, Inc.
d. Graham Architectural Products Corp.
e. Kawneer Company, Inc.
f. Peerless Products, Inc.
g. TRACO.
h. YKK AP America Inc.

2. Glazing: Insulated glass, as specified in Division 08 Section “Glazing”.

B. Window Type: Double Hung Windows.
1. Basis-of-Design Product: The design is based on Kawneer “8400TL Series Double Hung Window.” Subject to compliance with sightline enhanced mullion dimensions, operational design, and performance characteristics of the specified product, a comparable product may be proposed by other manufacturers of aluminum window systems. Comparable products are subject to review and approval through the submittal process specified.
2. Glazing: Insulated glass, tempered where indicated on the Drawings or required by Code, as specified in Division 08 Section “Glazing”.
3. Accessories:
a. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
b. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
c. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
d. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
e. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

2.2 MATERIALS, GENERAL

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.
1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.

E. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 FABRICATION

A. General: Fabricate aluminum windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. General: Fabricate aluminum windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/NWWDA 101/I.S.2 performance requirements for the following window type and performance class. Include a complete system for assembling components and anchoring windows.
   1. Fixed Windows: HC or AW.

C. Fabricate aluminum windows that are re-glazable without dismantling sash or ventilator framing.

D. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
   1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
   2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
   3. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.

E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

F. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/NWWDA 101/I.S.2.

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.4 ALUMINUM FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   1. Color: Match Aluminum-Framed Entrances and Storefronts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Remove and replace windows where test results indicate that they do not comply with specified requirements.

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

3.4 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 56 53 - SECURITY WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed, transaction security windows.

B. Related Requirements:
   1. Section 06 16 00 "Sheathing" for ballistic-resistant opaque wall panels.
   2. Section 08 88 53 "Security Glazing" for ballistic-resistant glass for security windows.

1.2 COORDINATION

A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for window units.

B. Shop Drawings: For security windows.
   1. Include plans, elevations, sections, and attachments to other work.
   2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
   3. Location of weep holes.
   4. Glazing details.
   5. Details of deal tray transaction counter and speaking aperture.

C. Samples for Initial Selection: For frame members with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Framing: 12-inch-long sections of frame members.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Welding certificates.

C. Product Test Reports: For each type of security window and accessory indicated as ballistics resistant, for tests performed by a qualified testing agency.

D. Configuration Disclosure Drawing: For each type of forced-entry-resistant security window, complying with ASTM F 1233.

E. Sample Warranty: For special warranty.

F. Examination reports documenting inspections of substrates, areas, and conditions.

G. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   2. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label security window packaging with drawing designation.

C. Store crated security windows on raised blocks to prevent moisture damage.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including deflections exceeding 1/4 inch.
      b. Failure of welds.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
   1. Ballistics Resistance: Listed and labeled as Level 3 when tested according to UL 752.

B. Structural Loads: Detention windows shall withstand the effects of wind loads, with no permanent deformation or breakage of components within window assembly when tested according to ASTM E 330.
   1. Wind Loads: As indicated on Structural Drawings**.**

C. Air Infiltration: Provide windows with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.

D. Water Penetration under Static Pressure: Provide windows that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

2.2 FIXED, TRANSACTION SECURITY WINDOWS

A. Provide fixed, framed transaction windows with operable sash or ventilator capable of allowing transfer of currency and documents.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Creative Industries, Inc.; SWE Series with custom deal tray, or comparable product by one of the following:
      a. Laurence, C. R. Co. Inc.
      b. National Bullet Proof, Inc.
      c. SABIC Innovative Plastics IP BV; Insulgard Security Products.

B. Configuration: As indicated on Drawings.

C. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:
   1. Profile: Manufacturer's standard, with minimum face dimension indicated.
   2. Depth: As indicated on Drawings.

D. Head and Jamb Framing: Designed for sealant glazing.

E. Glazing and Glazing Materials: Comply with requirements in Section 08 88 53 "Security Glazing."

F. Materials:
   1. Aluminum Extrusions: ASTM B 221. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.062 inch thick at any location for main frame and sash members.
   2. Aluminum Sheet and Plate: ASTM B 209.

G. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by the manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.
   1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard noncorrosive pressed-in splined grommet nuts.
   2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match the finish of the member or hardware being fastened, as appropriate.

2.3 FABRICATION

A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
   1. Provide units that are reglazable from the secure side without dismantling the nonsecure side of framing.
   2. Prepare security windows for glazing unless preglazing at the factory is indicated.

B. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.

C. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
   1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

D. Glazing Stops: Finish glazing stops to match security window framing.
   1. Secure-Side (Exterior) Glazing Stops: Welded or integral to framing.

E. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

G. Factory-cut openings in glazing for speaking apertures.

H. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Comply with requirements in Section 08 88 53 "Security Glazing."

I. Weather Stripping: Factory applied.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: Dark bronze.

2.6 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   3. Directional Satin Finish: No. 4.

2.7 ACCESSORIES

A. Recessed Deal Trays: Formed from stainless steel; fabricated with exposed flanges for recessed installation into horizontal surface.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Creative Industries, Inc.; 1611-S3 deal tray, or comparable product by another manufacturer.
   2. Size: 16 inches wide by 11 inches deep by 1-1/2 inches high.
   3. Opening Size: 14-1/2 inches wide by 9-1/2 inches deep.
   4. Ballistics Resistance: UL Level 3.
   5. Custom Cover: Stainless steel with felt weatherstripping.
   6. Custom Drainage: Provide weep hole and drainage tube.

B. Speaking Apertures: Fabricate from draft-free cast aluminum with clear plastic diaphragm, designed to allow passage of speech at normal speaking volume without distortion.
   1. Shape: Circular, 8.375 inches diameter.

2. Hole Size: 7-1/2 inches diameter.
3. Provide manufacturer's spacer or extender if required for glass thickness.
4. Ballistics Resistance: UL Level 3.
5. Finish: Clear anodized.
6. Basis-of-Design Product: Creative Industries; No. 8-D Talk Thru.

C. Amplified Speaking Apertures: Fabricate from aluminum, designed to allow passage of speech at normal speaking volume without distortion.
1. Shape: Circular, 5 inches diameter.
2. Hole Size: 3-1/2 inches diameter.
3. Provide manufacturer's spacer or extender if required for glass thickness.
4. Ballistics Resistance: UL Level 3.
5. Listed and labeled as bullet resisting according to UL 752.
6. Power Supply: 120V AC, 60 Hz.
7. Microphone: Gooseneck, removable.
8. Finish: Clear anodized.
9. Basis-of-Design Product: Norcon Communications; TTU-AJB.

D. Amplified Communication System: 2-piece units fabricated from aluminum, designed to allow passage of speech at normal speaking volume without distortion.
1. Shape: Prism, 6 inches wide by 2 3/8 inches high by 2 3/8 inches deep.
2. Mounting: Countertop, each side of glass (no hole).
3. Power Supply: 120V AC, 60 Hz.
4. Microphone: Gooseneck, removable.
5. Finish: Clear anodized.
6. Basis-of-Design Product: Norcon Communications; TTU-3 / 6"J.

E. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.

F. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch thick; with minimum 1/2-inch-diameter, headed studs welded to back of plate.

G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

H. Compression-Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping, such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

I. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.
1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
2. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
3. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

J. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressures indicated.

K. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

L. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

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 security windows.

B. Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level.
   1. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

C. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.

E. Inspect built-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements. Prepare inspection reports.
   1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
   2. Perform additional inspections to determine compliance of replaced or additional work. Prepare anchor inspection reports.

F. For glazing materials whose orientation is critical for performance, verify installation orientation.

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

3.2 PREPARATION

A. Coordination: Furnish layouts for anchors, clips, and other security window anchors whose installation is specified in other Sections.
   1. Furnish anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.
   1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same ballistics-resistance performance as security window.

B. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than 6 inches from each corner and spaced not more than 12 inches o.c.

C. Glazed Framing: Provide sealant -glazed framing. Comply with installation requirements in Section 08 88 53 "Security Glazing."

D. Removable Glazing Stops and Trim: Fasten components with security fasteners.

E. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.

F. Sealants: Comply with requirements in Section 07 92 00 "Joint Sealants" for installing sealants, fillers, and gaskets.
   1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
   2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.

G. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 ADJUSTING

A. Adjust transaction drawers to provide a tight fit at contact points and weather stripping for smooth operation and weathertight and secure enclosure.

B. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.5 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

B. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Section 08 88 53 "Security Glazing" for cleaning and maintenance.

C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

END OF SECTION

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
   2. Cylinders for door hardware specified in other Sections.
   3. Electrified door hardware.

B. Related Sections:
   1. Section 06 41 16 "Plastic-Laminate-Faced Architectural Cabinets" for cabinet door hardware provided with cabinets.
   2. Section 08 11 13 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
   3. Section 08 14 16 "Flush Wood Doors".
   4. Section 08 14 33 "Stile and Rail Wood Doors".
   5. Section 08 31 13 "Access Doors and Frames" for access door hardware, except cylinders.
   6. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, except cylinders.
   7. Section 13 34 19 "Metal Building Systems" for door hardware, except cylinders.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: For power, signal, and control wiring and including the following:
      a. Details of interface of electrified door hardware and building safety and security systems.
   2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
   1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.
      a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Other Action Submittals:
   1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
      b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
      c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
      d. Content: Include the following information:
         1) Identification number, location, hand, fire rating, size, and material of each door and frame.
         2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
         3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
         4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
         5) Fastenings and other pertinent information.
         6) Explanation of abbreviations, symbols, and codes contained in schedule.
         7) Mounting locations for door hardware.
         8) List of related door devices specified in other Sections for each door and frame.
   2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For electrified door hardware, from the manufacturer.
   1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Warehousing Facilities: In Project's vicinity.
   2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
   3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
   1. For door hardware, an Architectural Hardware Consultant (AHC) who is also an Electrified Hardware Consultant (EHC).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
   1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with The Department of Justice 2010 ADA Standards, and IBC and ICC/ANSI A117.1 or other locally enforced accessibility standards.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

G. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Inspect and discuss preparatory work performed by other trades.
   3. Inspect and discuss electrical roughing-in for electrified door hardware.
   4. Review sequence of operation for each type of electrified door hardware.
   5. Review required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail.

1.8 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
      a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
      b. Exit Devices: Two years from date of Substantial Completion.
      c. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA designations referenced.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Baldwin Hardware Corporation.

b. Bommer Industries, Inc.
c. Cal-Royal Products, Inc.
d. Hager Companies.
e. IVES Hardware; an Ingersoll-Rand company.
f. Lawrence Hardware Inc.
g. McKinney Products Company; an ASSA ABLOY Group company.
h. PBB, Inc.
i. Stanley Commercial Hardware; Div. of The Stanley Works.

2.3 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: BHMA A156.17.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. Baldwin Hardware Corporation.
b. Bommer Industries, Inc.
c. Cal-Royal Products, Inc.
d. Hager Companies.
e. Lawrence Hardware Inc.
f. McKinney Products Company; an ASSA ABLOY Group company.
g. PBB, Inc.
h. Stanley Commercial Hardware; Div. of The Stanley Works.

2.4 CENTER-HUNG AND OFFSET PIVOTS

A. Center-Hung and Offset Pivots: BHMA A156.4.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. DORMA Architectural Hardware; Member of The DORMA Group North America.
b. IVES Hardware; an Ingersoll-Rand company.
c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.5 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. Bommer Industries, Inc.
b. Cal-Royal Products, Inc.
c. Hager Companies.
d. IVES Hardware; an Ingersoll-Rand company.
e. McKinney Products Company; an ASSA ABLOY Group company.
f. Select Products Limited.
g. Stanley Commercial Hardware; Div. of The Stanley Works.
h. Zero International.

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
   2. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:
   1. Description: As indicated on Drawings.
   2. Levers: Forged or Cast.
   3. Escutcheons (Roses): Wrought.
   4. Dummy Trim: Match lever lock trim and escutcheons.
   5. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
   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: Manufacturer's special strike box fabricated for aluminum framing.
   4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Accurate Lock & Hardware Co.
      b. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
      c. Arrow USA; an ASSA ABLOY Group company.
      d. Best Access Systems; Div. of Stanley Security Solutions, Inc.
      e. Cal-Royal Products, Inc.
      f. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      g. Falcon Lock; an Ingersoll-Rand company.
      h. Marks USA.
      i. PDQ Manufacturing.
      j. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
      k. Schlage Commercial Lock Division; an Ingersoll-Rand company.
      l. Yale Security Inc.; an ASSA ABLOY Group company.

2.7 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
      b. Dortronics Systems, Inc.
      c. DynaLock Corp.
      d. Folger Adam Electric Door Controls; an ASSA ABLOY Group company.
      e. HES, Inc.; an ASSA ABLOY Group company.
      f. Rutherford Controls Int'l. Corp.
      g. Security Door Controls.
      h. Trine Access Technology.
      i. Von Duprin; an Ingersoll-Rand company.

2.8 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Door Controls International, Inc.
      b. Dortronics Systems, Inc.
      c. DynaLock Corp.
      d. Rutherford Controls Int'l. Corp.
      e. Schlage Commercial Lock Division; an Ingersoll-Rand company.
      f. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
      g. Security Door Controls.

B. Delayed-Egress Electromagnetic Locks: BHMA A156.24, electrically powered, with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than 3 seconds initiates irreversible alarm and 15-second delay for egress. When integrated with fire alarm, fire alarm voids 15-second delay.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Door Controls International, Inc.
      b. Doorguard Systems, Inc.
      c. DynaLock Corp.
      d. Rutherford Controls Int'l. Corp.
      e. Schlage Commercial Lock Division; an Ingersoll-Rand company.
      f. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

2.9 SELF-CONTAINED ELECTRONIC LOCKS

A. Self-Contained Electronic Locks: BHMA A156.25, mortise; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
      b. Kaba Ilco Corp.; a Kaba Group company.
      c. Marks USA.
      d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
      e. Schlage Commercial Lock Division; an Ingersoll-Rand company.
      f. Yale Security Inc.; an ASSA ABLOY Group company.

2.10 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: BHMA A156.29, Grade 1.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Arrow USA; an ASSA ABLOY Group company.
      b. Detex Corporation.
      c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.11 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
      b. Burns Manufacturing Incorporated.
      c. Don-Jo Mfg., Inc.
      d. Door Controls International, Inc.
      e. Hiawatha, Inc.
      f. IVES Hardware; an Ingersoll-Rand company.
      g. Trimco.

2.12 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
      b. Arrow USA; an ASSA ABLOY Group company.
      c. Cal-Royal Products, Inc.
      d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      e. Detex Corporation.
      f. Door Controls International, Inc.
      g. DORMA Architectural Hardware; Member of The DORMA Group North America.
      h. Dor-O-Matic; an Ingersoll-Rand company.
      i. K2 Commercial Hardware; a Black & Decker Corp. company.
      j. Monarch Exit Devices & Panic Hardware; an Ingersoll-Rand company.
      k. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc.
      l. Rutherford Controls Int'l. Corp.
      m. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
      n. Von Duprin; an Ingersoll-Rand company.
      o. Yale Security Inc.; an ASSA ABLOY Group company.

2.13 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
   1. Manufacturer: Same manufacturer as for locking devices.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Arrow USA; an ASSA ABLOY Group company.
      b. ASSA, Inc.; An ASSA ABLOY Group Company.
      c. Best Access Systems; Div. of Stanley Security Solutions, Inc.
      d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      e. Falcon Lock; an Ingersoll-Rand company.
      f. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
      g. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
      h. Schlage Commercial Lock Division; an Ingersoll-Rand company.
      i. Yale Security Inc.; an ASSA ABLOY Group company.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.

C. High-Security Lock Cylinders: BHMA A156.30; Grade 1; Type M, mechanical or E, electrical; permanent cores that are removable; face finished to match lockset.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.14 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Existing System:
      a. Master key or grand master key locks to Owner's existing system.
   2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.
   1. Quantity: In addition to one extra key blank for each lock, provide the following:
      a. Master Keys: Five.
      b. Grand Master Keys: Five.

2.15 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Burns Manufacturing Incorporated.
      b. Don-Jo Mfg., Inc.
      c. Forms + Surfaces.
      d. Hager Companies.
      e. Hiawatha, Inc.
      f. IVES Hardware; an Ingersoll-Rand company.
      g. Rockwood Manufacturing Company.
      h. Trimco.

2.16 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.17 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Arrow USA; an ASSA ABLOY Group company.
      b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      c. DORMA Architectural Hardware; Member of The DORMA Group North America.
      d. Dor-O-Matic; an Ingersoll-Rand company.
      e. K2 Commercial Hardware; a Black & Decker Corp. company.
      f. LCN Closers; an Ingersoll-Rand company.

g. Norton Door Controls; an ASSA ABLOY Group company.
h. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
i. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
j. Yale Security Inc.; an ASSA ABLOY Group company.

2.18 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. DORMA Architectural Hardware; Member of The DORMA Group North America.
b. LCN Closers; an Ingersoll-Rand company.
c. Norton Door Controls; an ASSA ABLOY Group company.
d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.19 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by loss of power.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
b. DORMA Architectural Hardware; Member of The DORMA Group North America.
c. LCN Closers; an Ingersoll-Rand company.
d. Norton Door Controls; an ASSA ABLOY Group company.
e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
f. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.20 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
a. Architectural Builders Hardware Mfg., Inc.
b. Baldwin Hardware Corporation.
c. Burns Manufacturing Incorporated.
d. Cal-Royal Products, Inc.
e. Don-Jo Mfg., Inc.
f. Door Controls International, Inc.
g. Hager Companies.
h. Hiawatha, Inc.
i. IVES Hardware; an Ingersoll-Rand company.
j. Rockwood Manufacturing Company.
k. Stanley Commercial Hardware; Div. of The Stanley Works.
l. Trimco.

2.21 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Architectural Builders Hardware Mfg., Inc.
      b. DORMA Architectural Hardware; Member of The DORMA Group North America.
      c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.22 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Architectural Builders Hardware Mfg., Inc.
      b. Glynn-Johnson; an Ingersoll-Rand company.
      c. Rockwood Manufacturing Company.
      d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.23 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Hager Companies.
      b. M-D Building Products, Inc.
      c. National Guard Products.
      d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
      e. Reese Enterprises, Inc.
      f. Sealeze; a unit of Jason Incorporated.
      g. Zero International.

2.24 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Hager Companies.
      b. M-D Building Products, Inc.
      c. National Guard Products.
      d. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
      e. Reese Enterprises, Inc.
      f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
      g. Sealeze; a unit of Jason Incorporated.
      h. Zero International.

2.25 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
      a. Baldwin Hardware Corporation.
      b. Burns Manufacturing Incorporated.
      c. Don-Jo Mfg., Inc.
      d. Hiawatha, Inc.
      e. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
      f. IVES Hardware; an Ingersoll-Rand company.
      g. Pawling Corporation.
      h. Rockwood Manufacturing Company.
      i. Trimco.

2.26 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames.
         2) Strike plates to frames.
         3) Closers to doors and frames.
      b. Steel Through Bolts: For the following unless door blocking is provided:
         1) Surface hinges to doors.
         2) Closers to doors and frames.
         3) Surface-mounted exit devices.
   3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.27 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as directed by Owner.

F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
   1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

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

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

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

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
   1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

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.
   1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
   2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 01 79 00 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

A. The following hardware sets represent the design intent and direction of Owner and Architect and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of Architect. Omitted items not included in hardware set(s) should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Abbreviations For Listed Manufacturers:
1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA – Sargent
5. RF - Rixson
6. NO – Norton
7. OT - Other

Set: 1.0

Doors: 01.00.02A, 01.00.06A, 01.15.05B, 01.40.03A

1	Continuous Hinge	CFM83HD1 Per Door Hgt		PE
1	Rim Exit Device, Classroom	DG1 43 8813 ETL	US32D	SA
1	Surface Closer	SRI 281 PS	EN	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Threshold	2005AT		PE
1	Gasketing	2891AS (Head)		PE
2	Gasketing	290AS (Jambs)		PE
1	Sweep	315CN		PE

Notes: Mount weatherstripping prior to mounting closer bracket.

Set: 2.0

Doors: 01.03.01A, 01.03.01B

2	Continuous Hinge	DFM83SLI-HD1 PT		PE
1	Concealed Vert Rod Exit, Nightlatch	DG1 10 16 43 55 56 64 AD8610 113 Less Pull	US10BE	SA
1	Concealed Vert Rod Exit, Exit Only	43 55 56 AD8610 EO	US10BE	SA
2	Door Pull	RM3311-48 Mtg-Type 12HD	US10BE	RO
2	Conc Overhead Stop	1ADJ-X36	613E	RF
2	Surface Closer	351 P10 351D 581-2	EB	SA
1	Threshold	2005AT		PE
2	Sweep	345ANB		PE

Notes: Perimeter seal and astragal furnished by the door supplier.
Exit devices include electric latch retraction for access control by others. All wires and wiring by the security contractor. Key override on one leaf for authorized egress.

Set: 3.0

Doors: 01.03.01C

2	Continuous Hinge	DFM83SLI-HD1 PT Per Door Hgt		PE
1	Concealed Vert Rod Exit, Nightlatch	DG1 10 16 43 55 56 64 AD8610 113 Less Pull	US10BE	SA
1	Concealed Vert Rod Exit, Exit Only	43 55 56 AD8610 EO	US10BE	SA
2	Door Pull	RM3311-48 Mtg-Type 12HD	US10BE	RO
1	Conc Overhead Stop	1ADJ-X36	613E	RF
1	Surface Closer	351 P10 351D 581-2	EB	SA
1	Automatic Opener	6332	689	NO
1	Threshold	2005AT		PE
2	Sweep	345ANB		PE
1	Door Switch	503		NO
1	Door Switch	504		NO

Notes: Perimeter seal and astragal furnished by the door supplier.
Exit devices include electric latch retraction for access control by others and use with the automatic operator. When the door switch button is pushed it will cause the automatic operator to signal the exit device to retract its latch, then the operator will open the door. Door switch 503 to mount on the exterior of the opening, door switch 504 has 2 buttons, mounts in the vestibule to operate both doors 01.03.01C and 01.03.02C.
All wires and wiring by the security contractor. Key override on one leaf for authorized egress.

Set: 4.0

Doors: 01.03.02A, 01.03.02B

2	Continuous Hinge	DFM83SLI-HD1 Per Door Hgt		PE
2	Door Pull	RM3311-48 Mtg-Type 12HD	US10BE	RO
2	Push Bar	RM3112 Mtg-Type 12XHD x B to B w/ Pull	US32D	RO
2	Surf Overhead Hold Open	9ADJ-X26	613E	RF
2	Surface Closer	281 PD10	EB	SA
2	Wall Stop	406	US10BE	RO

Set: 5.0

Doors: 01.03.02C

2	Continuous Hinge	DFM83SLI-HD1 Per Door Hgt		PE
2	Door Pull	RM3311-48 Mtg-Type 12HD	US10BE	RO
2	Push Bar	RM3112 Mtg-Type 12XHD x B to B w/ Pull	US32D	RO
1	Surf Overhead Hold Open	9ADJ-X26	613E	RF
1	Surface Closer	281 PD10	EB	SA
1	Automatic Opener	6332	689	NO
2	Wall Stop	406	US10BE	RO
1	Door Switch	503		NO

Notes: Automatic operator. 503 door switch mounts on the interior side of the opening. Pushing the door switch button will signal the automatic operator to open the door. All wires and wiring by the installer.

Set: 6.0

Doors: 01.03.02D, 01.03.02E, 01.03.02F, 01.03.02G, 01.11.02E, 01.11.02F

2	Continuous Hinge	DFM83SLI-HD1 Per Door Hgt		PE
1	Concealed Vert Rod Exit, Nightlatch	DG163 43 AD8610 Less Pull	US10BE	SA
1	Concealed Vert Rod Exit, Nightlatch	DG163 16 43 AD8610 113 Less Pull	US10BE	SA
2	Door Pull	RM3311-48 Mtg-Type 12HD	US10BE	RO
2	Surf Overhead Hold Open	9ADJ-X26	613E	RF
2	Surface Closer	281 PD10	EB	SA
2	Wall Stop	406	US10BE	RO

Set: 7.0

Doors: 01.00.08A

3	Hinge	TA2714(NRP) @Outswing Doors) 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	DG1 8237 LNL	US32D	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Wall Stop	406	US32D	RO
3	Silencer	608-RKW		RO

Set: 8.0

Doors: 01.04.01A, 01.15.02A

3	Hinge	TA2714(NRP) @Outswing Doors) 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	DG1 8237 LNL	US32D	SA
1	Surf Overhead Stop	9-X36	652	RF
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
3	Silencer	608-RKW		RO

Set: 9.0

Doors: 01.08.01D, 01.08.01M, 01.08.01P, 01.11.02L, 01.11.02O, 01.42.01C, 01.42.01G, 01.44.01B, 01.44.01E

1	Continuous Hinge	CFM83HD1 Per Door Hgt		PE
1	Rim Exit Device, Classroom	DG1 43 8813 ETL	US32D	SA
1	Surf Overhead Stop	9ADJ-X36	630	RF
1	Surface Closer	SRI 281 PS	EN	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Threshold	1715A		PE
1	Gasketing	2891AS (Head)		PE
1	Gasketing	290AS (Jambs)		PE
1	Rain Guard	346C		PE
1	Sweep	315CN		PE

Notes: Mount weatherstripping prior to mounting closer bracket.

Set: 10.0

Doors: 01.08.01A, 01.08.01C, 01.08.01F, 01.08.01K, 01.08.01N, 01.11.02A, 01.11.02D

2 Continuous Hinge	CFM83HD1 Per Door Hgt		PE
2 Surface Vert Rod Exit	DG1 8706 ETL	US32D	SA
2 Surface Vert Rod Exit, Exit Only	8710 EO	US32D	SA
2 Surf Overhead Stop	9ADJ-X36	630	RF
2 Surface Closer	SRI 281 PS	EN	SA
2 Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	2891AS (Head)		PE
2 Gasketing	290AS (Jambs)		PE
1 Rain Guard	346C		PE
2 Sweep	315CN		PE
2 Astragal	303APK		PE

Notes: Mount weatherstripping prior to mounting closer bracket.

Set: 11.0

Doors: 01.15.01A

2 Continuous Hinge	CFM83HD1 Per Door Hgt		PE
2 Surface Bolt	582-12	US32D	RO
1 Storeroom Deadbolt Lock	DG1 8251 LNL	US32D	SA
2 Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	2891AS (Head)		PE
2 Gasketing	290AS (Jambs)		PE
1 Rain Guard	346C		PE
2 Astragal	303APK		PE

Notes: Mount weatherstripping prior to mounting closer bracket.

Set: 12.0

Doors: 01.15.08A

1 Continuous Hinge	CFM83HD1 Per Door Hgt		PE
1 Storeroom Deadbolt Lock	DG1 8251 LNL	US32D	SA
1 Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1 Threshold	1715A		PE
1 Gasketing	2891AS (Head)		PE
2 Gasketing	290AS (Jambs)		PE
1 Rain Guard	346C		PE
1 Sweep	315CN		PE

Notes: Mount weatherstripping prior to mounting closer bracket.

Set: 13.0

Doors: 01.00.01A, 01.00.06B, 01.00.06C, 01.01.01A, 01.01.01B, 01.02.01A, 01.02.03A, 01.04.04A, 01.05.01A, 01.06.02A, 01.06.02B, 01.07.01A, 01.07.02A, 01.11.02H, 01.11.02J, 01.11.02Q, 01.11.02R, 01.40.02A, 01.42.01E

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Classroom Lock	DG1 8237 LNL	US32D	SA
1	Surf Overhead Stop	10-X36	630	RF
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
3	Silencer	608-RKW		RO

Set: 14.0

Doors: 01.01.03A, 01.01.03B, 01.04.05A

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Storeroom/Closet Lock	DG1 8204 LNL	US32D	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Wall Stop	406	US32D	RO
3	Silencer	608-RKW		RO

Set: 15.0

Doors: 01.00.03A, 01.00.05A, 01.04.03A, 01.06.01A, 01.15.03A, 01.15.07A

3	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Push Plate	73E	US32D	RO
1	Push Pull	111x73CL	US32D	RO
1	Surface Closer	351 O	EN	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Wall Stop	406	US32D	RO
3	Silencer	608-RKW		RO

Set: 16.0

Doors: 01.15.05A

3	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Deadlock	4877	US26D	SA
1	Push Plate	73E	US32D	RO
1	Push Pull	111x73CL	US32D	RO
1	Surface Closer	351 O	EN	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Wall Stop	406	US32D	RO
3	Silencer	608-RKW		RO

Set: 17.0

Doors: 01.00.04A, 01.00.07A, 01.04.02A, 01.15.04A, 01.15.06A, 01.40.01A

3	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	LB V10 8265 LNL	US26D	SA
1	Surface Closer	351 O	EN	SA
1	Kick Plate	K1050 10" x Width Req'd CSK BEV	US32D	RO
1	Wall Stop	406	US32D	RO
3	Silencer	608-RKW		RO

Set: 18.0

Doors: 01.07.02B, 01.07.02C, 01.08.01B, 01.08.01E, 01.08.01G, 01.08.01H, 01.08.01I, 01.08.01J, 01.08.01L, 01.08.01O, 01.10.02K, 01.11.02B, 01.11.02C, 01.11.02G, 01.11.02I, 01.11.02M, 01.11.02N, 01.11.02P, 01.11.02S, 01.40.02B, 01.42.01B, 01.42.01D, 01.42.01F, 01.42.01H, 01.44.01A, 01.44.01C, 01.44.01D, 01.44.01F

1	Door to have slide lock	With prep for padlock	OT

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Glass for windows, doors, interior borrowed lites, storefront framing, and glazed curtain walls.
2. Glazing sealants and accessories.
3. Solar control film overlay.

B. Related Requirements:
1. Section 08 14 16 “Flush Wood Doors.”
2. Section 08 44 13 “Glazed Aluminum Curtain Walls" for glazing sealants used in glazed curtain walls.
3. Section 08 88 53 "Security Glazing."

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
1. Tinted glass.
2. Coated glass.
3. Insulating glass.
4. Each type of solar film overlay.

C. Glazing Accessory Samples: For, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricators of insulating-glass units with sputter-coated, low-E coatings, glass testing agency and sealant testing agency.

B. Product Certificates: For glass.

C. Product Test Reports: For tinted glass, coated glass, insulating glass and glazing sealants, for tests performed by a qualified testing agency.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of film overlay to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts", Section 08 51 13 "Aluminum Windows", and Section 08 44 13 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, glass with solar film overlay, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
   2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

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

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.12 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
   1. AGC Glass Company North America, Inc.
   2. Guardian Industries Corp.
   3. Pilkington North America.
   4. SCHOTT North America, Inc.
   5. Viracon, Inc.
   6. Vitro Architectural Glass (formerly PPG Industries, Inc.)

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
   1. Obtain tinted glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing. Engineer must be licensed in the State of Oklahoma.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
   1. Design Wind Pressures: As indicated on Drawings.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
   4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm.
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Ultraclear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. AGC Glass Company North America, Inc.; Krystal Klear.
      b. Guardian Industries Corp.; Ultrawhite.
      c. Pilkington North America; Optiwhite.
      d. Vitro Architectural Glass; Starphire.

C. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

D. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
      a. Roll-Wave Distortion Limits: Maximum peak to valley deviation of 0.003 inch in center field of lite, and 0.008 inch within 10.5 inches of leading and trailing edges.
      b. Millidiopter: Plus or minus 100 mD over 95 percent of glass surface.
      c. Overall Bow/Warp, Maximum: ASTM C 1048 Table 2 requirements, but not exceeding 0.50-inch regardless of edge dimension.
      d. Maintain measurement documentation for each lite. Upon request provide documentation for verification.

E. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
      a. Roll-Wave Distortion Limits: Maximum peak to valley deviation of 0.003 inch in center field of lite, and 0.008 inch within 10.5 inches of leading and trailing edges.
      b. Millidiopter: Plus or minus 100 mD over 95 percent of glass surface.
      c. Overall Bow/Warp, Maximum: ASTM C 1048 Table 2 requirements, but not exceeding 0.50-inch regardless of edge dimension.
      d. Maintain measurement documentation for each lite. Upon request provide documentation for verification.

F. Solar Film Overlay: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Decorative Films LLC, Ultracool-IR8360 IR And UV Blocking Solar Film; or comparable product by one of the following:
      a. Avery Dennison Graphics.
      b. FDC Graphic Films, Inc.
      c. 3M.
   2. Contractor Note: All solar control film colors must be approved by Architect and Owner prior to final installation. Refer to Article 1.8.C above for mockups.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of hermetic sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
   1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
   2. Spacer: Provide spacers with bent corners.
   3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 795.
      b. GE Advanced Materials - Silicones; SilPruf NB SCS9000.
      c. Pecora Corporation; 895NST.
      d. Polymeric Systems, Inc.; PSI-641.
      e. Sika Corporation U.S.; Sikasil WS-295.
      f. Tremco Incorporated; Spectrem 2.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

C. Solar Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass (#4 surface), according to manufacturer's written instructions, including surface preparation and application temperature limitations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type G4: Clear heat-strengthened float glass.
   1. Provide if indicated on Architectural Drawings.

B. Glass Type G3: Clear fully tempered float glass.
   1. Safety glazing required.
   2. Refer to Article 2.4 B above for glass fabrication process.

3.9 INSULATING GLASS SCHEDULE

A. Glass Type G2: Low-E-coated, clear insulating glass.
   1. Basis-of-Design Product: Vitro Architectural Glass, Solarban 60 (2) Clear + Clear.
   2. Overall Unit Thickness: 1 inch.
   3. Indoor and Outdoor Lites: Heat-strengthened or fully tempered float glass.
   4. Interspace Content: Argon.
   5. Low-E Coating: Sputtered on second surface.
   6. Winter Nighttime U-Factor: 0.24 maximum.
   7. Visible Light Transmittance: 70 percent minimum.
   8. Solar Heat Gain Coefficient: 0.39 maximum.
   9. Safety glazing required for fully tempered glass.
   10. Provide continuous edge deletion for all low-E coatings.

B. Glass Type G1: Low-E-coated, tinted insulating glass.
   1. Basis-of-Design Product: Vitro Architectural Glass, Solarban 60 (2) Optigray + Clear.
   2. Overall Unit Thickness: 1 inch.
   3. Outdoor Lite: Tinted heat-strengthened or fully tempered float glass.
   4. Tint Color: Gray.
   5. Interspace Content: Argon.
   6. Indoor Lite: Clear heat-strengthened or fully tempered float glass.
   7. Low-E Coating: Sputtered on second surface.
   8. Winter Nighttime U-Factor: 0.24 maximum.
   9. Visible Light Transmittance: 50 percent minimum.
   10. Solar Heat Gain Coefficient: 0.30 maximum.
   11. Safety glazing required for fully tempered glass.
   12. Provide continuous edge deletion for all low-E coatings.

3.10 SECURITY GLAZING

A. Glass Type G5: Clear safety laminated glass and polycarbonate panels, Level 3 ballistics resistance. Refer to the requirements of Specification Section 08 88 53 “Security Glazing.”

END OF SECTION

SECTION 08 88 53 - SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass-clad polycarbonate for the following applications:
   1. Ticket windows.

B. Related Requirements:
   1. Section 06 16 00 "Sheathing" for ballistic-resistant opaque wall panels.
   2. Section 08 56 53 "Security Windows" for ballistic-resistant transaction windows.

1.2 DEFINITIONS

A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Security Glazing Samples: For each type of security glazing; 12 inches square.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths.

D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product indicated, from manufacturer.

B. Product Test Reports: For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.
   1. Provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test reports.

E. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.

B. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:
   1. H. P. White Laboratory, Inc.
   2. Underwriters Laboratories, Inc.
   3. Wiss, Janney, Elstner Associates, Inc.

C. Sealant Testing Agency Qualifications: Qualified according to ASTM C 1021 for testing indicated.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.
   2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
   3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F

1.10 WARRANTY

A. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration of glass-clad polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each security glazing type indicated.

B. Source Limitations for Glazing Sealants: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General:
   1. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated.
   1. Design Procedure for Glass: ASTM E 1300 and ICC's International Building Code.
   2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      a. Basic Wind Speed: As indicated on Structural Drawings.
      b. Importance Factor: 3.
      c. Exposure Category: C.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.
   1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
   1. Ballistics Resistance: Listed and labeled as Level 3 when tested according to UL 752.

2.3 SECURITY GLAZING, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.

D. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

E. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

F. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and on procedures indicated below:
   1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F
   2. Solar-Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For fully tempered float glass, comply with requirements for Kind FT.
   3. For uncoated glass, comply with requirements for Condition A.

C. Chemically Strengthened Glass: Annealed float glass is chemically strengthened to comply with ASTM C 1422, Surface Compression Level 3 and Case Depth Level C.

2.5 INSULATING SECURITY GLAZING

A. Insulating Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace, qualified according to ASTM E 2190
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   2. Spacer: Manufacturer's standard spacer material and construction and matching in color to adjacent glazing**.**
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.6 AIR-GAP SECURITY GLAZING

A. Air-Gap Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   2. Spacer Specifications: Manufacturer's standard rigid spacer material and construction.

2.7 SPALL-RESISTANT FILM

A. Spall-Resistant Film: Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.

B. Laminating Process: Factory laminate spall-resistant film to glazing assemblies to produce laminated lites free of foreign substances, air, and glass pockets.

2.8 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 790.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2700 SilPruf LM.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation; Bondaflex Sil 290.
      d. Pecora Corporation; 890NST.
      e. Sika Corporation; Sikasil WS-290.
      f. Tremco Incorporated; Spectrem 1.

C. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C 920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C 661.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Corporation-Construction Systems.
      b. Pecora Corporation; DynaFlex.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing for security glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Minimum required bite.
   5. Effective sealing between joints of framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed, extruded-aluminum louvers.

B. Related Requirements:
   1. Section 08 11 13 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
   2. Section 09 96 00 “High Performance Coatings” for field painting louvers.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
   2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Windborne-debris-impact-resistance test reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated. Engineer must be licensed in the State of Oklahoma.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: Determine loads based on pressures as indicated on Structural Drawings.

C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet of grade shall pass enhanced-protection, large-missile testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.

D. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Design earthquake spectral response acceleration, short period (Sds) for Project is indicated on Structural Drawings.
   2. Component Importance Factor: 1.0.

E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

G. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Sightproof, Drainable-Blade Louver :
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Airolite Company, LLC (The).
      b. Construction Specialties, Inc.
      c. Ruskin Company; Tomkins PLC.
   2. Louver Depth: 5 inches.

3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:
   a. Free Area: Not less than 8.3 sq. ft. for 48-inch-wide by 48-inch-high louver.
   b. Point of Beginning Water Penetration: Not less than 750 fpm.
   c. Air Performance: Not more than 0.10-inch wg static pressure drop at 550-fpm free-area exhaust velocity.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Bird screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Same finish as louver frames to which louver screens are attached.
   3. Type: Non-rewirable, U-shaped frames.

D. Louver Screening for Aluminum Louvers:
   1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern where indicated.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Exterior flange unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
   1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
   2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with mullions at corners.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds , threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

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SECTION 08 95 16 - WALL VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall vents.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of metal finish required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vents from single source from single manufacturer.

2.2 WALL VENTS (BRICK VENTS)

A. Extruded-Aluminum Wall Vents:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Airolite Company, LLC (The).
      b. Construction Specialties, Inc.
      c. Hohmann & Barnard, Inc.
      d. Ruskin Company; Tomkins PLC.
   2. Extruded-aluminum louvers and frames, not less than 0.125-inch nominal thickness, assembled by welding; with 18-by-14-mesh, aluminum insect screening on inside face; incorporating weep holes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction.
   3. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
   4. Finish: Mill.

2.3 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place vents level, plumb, and at indicated alignment with adjacent work.

B. Protect unpainted surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

C. Build vents into masonry work as construction progresses; comply with requirements in Section 04 20 00 "Unit Masonry."

3.2 ADJUSTING AND CLEANING

A. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

B. Restore vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:
1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
2. Section 09 29 00 “Gypsum Board”.

C. Nomenclature: Framing products provided under this Section are indicated on the Drawings as “steel studs.” Structural framing specified in Section 05 40 00 "Cold-Formed Metal Framing" is indicated on the Drawings as “metal framing.”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
1. Steel Studs and Runners:
   a. Base-Metal Thickness: 0.033 inch Minimum and as indicated in the Partition Type schedule in the Drawings.
   b. Depth: as indicated in the Partition Type schedule in the Drawings.
2. Embossed Steel Studs and Runners:
   a. Basis of Design Product: Clark Dietrich ProStud 30 or equal as determined by Architect. Note that Clark Dietrich ProStud 20 or equivalent products will not be accepted as an equal to steel studs with thickness of 0.033 inch.
      1) Products: Subject to prior approval of Architect through Substitution Form, available products that may be incorporated into the Work include the following:
         a) MarinoWare; ViperStud.
         b) CEMCO; ViperStud.
         c) Telling Industries; ViperStud.
   b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
         2) Telling Industries; True-Action Slotted Track.
         3) Steel Network Inc: VertiClip SLF or VTD.
         4) Marinoware; Slotted Track.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.053 inch.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.018 inch.
   2. Depth: 7/8 inch.

2.2 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.106-inch- inch in diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch-wide flanges.
   1. Depth: 1-1/2 inches.

D. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
   2. Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.033 inch.
      b. Depth: As indicated on Drawings.

E. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Company LLC, a division of ROCKFON; Drywall Grid System.
      c. USG Corporation; Drywall Suspension System.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:
   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Where Architectural Drawings don't indicate expansion or control joint locations, provide graphic submittal indicating joint locations to meet this standard for joint spacing.
   2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, signage, television monitor supports, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
d. Provide box beam header at all door and framed openings larger than 3'-4" wide. Size header according to deflection and overall width of opening.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior mold and mildew resistant gypsum board.
2. Interior abuse-resistant gypsum board.
3. Tile backing panels.
4. Sound Batt Insulation.

B. Related Requirements:
1. Division 09 Section "Sheathing" for gypsum sheathing for exterior walls and soffits.
2. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels, identified on Drawings as “steel studs.”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of gypsum board mounted to ceiling framing and control joint pattern. Show widths, details, and locations of expansion and control joints.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Source Limitations: Obtain each type of panel product from single source from single manufacturer.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Gypsum Board: ASTM C 1396/C 1396M, with moisture- and mold-resistant core and paper surfaces.
   1. Product: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum; M-BLOC Type X.
      b. CertainTeed Corp.; ProRoc Moisture and Mold Resistant Type X.
      c. Georgia-Pacific Gypsum LLC; ToughRock Fireguard X Mold-Guard.
      d. National Gypsum Company; Gold Bond Brand XP Fire-Shield.
      e. USG Corporation; Sheetrock Mold Tough Firecode Core.
   2. Core: 5/8 inch, Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D 3273, score of 10.

B. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, with Level 3 surface abrasion resistance, Level 1 or better indentation resistance, and Level 2 or better soft body impact resistance.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum; M-Bloc AR Type X.
      b. CertainTeed Corp.; AirRenew Extreme Abuse.
      c. National Gypsum Company; Gold Bond Hi-Abuse XP.
   2. Core: 5/8 inch, Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D 3273, score of 10.

2.3 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; GlasRoc Tile Backer.
      b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
      c. National Gypsum Company; e2XP Tile Backer.
   2. Core: 5/8 inch, Type X.
   3. Mold Resistance: ASTM D 3273, score of 10.
   4. Provide at Wash Bay side of wall separating Restroom 01.15.07 and Fire Pump Room 01.15.08 from east Wash Bay area 01.15.09, along grid K.
      a. Refer to Section 09 91 23 “Interior Painting” for epoxy primer and paint coating.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1325, with manufacturer's standard edges. Contractor must use cement board in shower rooms behind tile.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. FinPan, Inc; ProTEC Concrete Backer Board.
      b. National Gypsum Company, Permabase Cement Board.
   2. Thickness: 5/8 inch.
   3. Mold Resistance: ASTM D 3273, score of 10.

C. Use cement board at ceilings in wet areas.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead on outside corners, unless otherwise indicated.

b. LC-Bead: J-shaped; exposed long flange receives joint compound. Use for edge trim, unless otherwise indicated.
c. L-Bead: L-shaped; exposed long flange receives joint compound. Use where indicated.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound. Use where indicated.
e. Expansion (control) joint. One-piece expansion joint formed with V-shaped slot and removable strip covering slot opening.
f. Curved-Edge Cornerbead: With notched or flexible flanges.
g. Reveal, profile as indicated.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Compound for Interior Gypsum Board:
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

C. Joint Tape and Joint Compound: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Interior Gypsum Board: Open-weave glass mesh, 2” minimum width.
a. Compound: Ready Mix.
1) Basis of Design: National Gypsum, Proform Multi-use Joint Compound.
2. Interior Moisture and Mold Resistant Board: fiberglass mesh, 1.9” minimum width.
a. Compound: setting type.
3. Joint Compound for Tile Backing Panels:
a. Tape: Alkali resistant tape, 2” minimum width.
1) Basis of Design: National Gypsum, PermaBase Cement Board Tape.
b. Compound: Thin set mortar.
1) Basis of Design:
a) Laticrete 254 Platinum per ASTM A-118.4.
b) Laticrete 211 and Laticrete 4237 per ASTM A-118.1.

D. Tile Backing Panel Finish Materials for Non-Tiled Applications: For high-humidity and wet non-tiled and painted surfaces, use cement board and comply with tile backing panel manufacturer’s written instructions and filling joints as described above in joint compound..
1. Base and Skim Coats: Portland cement and polymer adhesive based materials comparable to one of the following, and acceptable to panel manufacturer:
a. Dryvit; Genesis DM, DS174.
b. Sto Corporation; F-477 Flexyl.
c. Parex; ParFlex.
d. Synergy; Xtra-Stop.
2. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:
a. Surface Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
b. Joint and Corner Reinforcing Mesh: 6 inch coated mesh tape.
3. Epoxy Paint Finish: As specified in Section 09 91 23 "Interior Painting."

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool. The depth of sound attenuation blanket to match the depth of the metal stud.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Mansville: MinWool or Sound & Fire Block batts.
      b. Knauf: Ecose.
      c. Owens Corning: Sound Attenuation Batts Fiber Glass.

D. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, including floors. Provide 1/8 - 1/4-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Moisture- and Mold-Resistant Type: All dry vertical and ceiling surfaces, unless otherwise indicated.
   2. Abuse-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations subject to indirect moisture or high-humidity, that are non-tiled locations with epoxy painted surfaces where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile in areas subject to direct wetting (e.g. showers, hydrotherapy rooms, steam rooms), as a substrate for wall base at locations indicated to receive resinous flooring with integrally coved wall base, and where indicated.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
   1. Where possible, install vertical control joints at outer edge of door frame.
   2. At ceiling locations, describe on Shop Drawings prior to installation.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.

2. LC-Bead: Use where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
3. L-Bead: Use where edge trim can only be installed after gypsum panels are installed.
4. U-Bead: Use where indicated.
5. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
   1. Use elastomeric sealant at door frames in lieu of joint compound.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. At cove light locations, provide level 5 finish at horizontal ceiling surfaces illuminated by cove lighting. Adjacent vertical gypsum board inside the cove may be level 4.

D. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
   1. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   2. Fill Coat: For second coat, use setting-type, sandable topping compound.
   3. Finish Coat: For third coat, use setting-type, sandable topping compound.
   4. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

E. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile, and where indicated.
   3. Level 4: At panel surfaces that will be exposed to view and scheduled to receive wall covering or flat paint finish (MPI Gloss Level 1), unless otherwise indicated.
      a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
      b. Extend wall finish level into coves and reveals.
   4. Level 5: At curved partitions, partitions with continuous unbroken length of 20 feet or greater, horizontal and vertical surfaces of soffits, surfaces scheduled to receive paint finish with a sheen of Gloss Level 2 or greater, surfaces scheduled to receive graphic film, and where indicated.
      a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

G. Tile Backing Panel Finish for High-Humidity and Wet Non-Tile Areas:
   1. Apply base coat to exposed surfaces of tile backing panel in minimum thickness of 1/16-inch dry-coat thickness.
   2. Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
   3. Apply skim coat to completely embed mesh over entire surface and to achieve a fine sand texture.
   4. Epoxy Paint Finish: As specified in Section 09 91 23 "Interior Painting."

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 30 13 – TILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ceramic mosaic tile.
2. Ceramic tile.
3. Porcelain tile.
4. Glazed wall tile.
5. Waterproof membrane.
6. Crack isolation membrane.
7. Metal edge strips.

B. Related Requirements:
1. Section 03 54 16 “Hydraulic Cement Underlayment” for underlayments installed in this section.
2. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Section 09 29 00 "Gypsum Board" for cementitious backer units.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

E. Large-Format Tile: Tiles with face size greater than 144 sq. in. (929 sq. cm), or tiles with at least one side greater than 15 inches.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
2. Review joint locations and how each joint will be treated.
3. Surface preparation.
4. Oversized tile installation.
5. Grouting materials and procedures.
6. Cleaning and protecting of tile surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated.
   1. For of each type tile that comes in color blend patterns, provide full sheets of each color blend.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Metal edge strips in 6-inch lengths.
   5. Grout samples for final color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product.

C. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, according to Section 01 40 00 “Quality Requirements.”
   1. Individual installer(s) working for installing contractor are certified through Advanced Certifications for Tile Installers (ACT) for installation of Large Format Tile and Substrate Preparation.
   2. Installer meets the requirements of a program identified and approved by the Architect with the criteria for such program similar to or exceeding Advanced Certifications for Tile Installers (ACT) for installation of Large Format Tile and Substrate Preparation, Membranes Shower Receptors or Ceramic Tile Education Foundation (CTEF) Certified Tile Installer Program or National Tile Contractors’ Association (NTCA) Five Star Contractor Program or Tile Contractors’ Association of America (TCAA) Trowel of Excellence Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Oversized porcelain tiles have additional delivery and handling requirements and may require mechanized equipment; follow manufacturer’s written recommendations.

C. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Do not store outside.

D. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

E. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product for designations CT1 through CT6, and CTB1: Refer to the Finish Legend and the Drawings. Subject to compliance with requirements, provide the product listed in the Finish Legend or comparable products as determined through the Substitution process outlined in Division 01.

B. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
   2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Metal edge strips.
   4. Joint Sealants.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 and ANSI A326.3 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS (CT1 through CT6, CTB1)

A. Tile:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Finish Legend.
   2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
   3. Dynamic Coefficient of Friction: For floor tile, not less than 0.42.
   4. Tile Color and Pattern: As indicated in finish legend.
   5. Grout Color: As indicated in finish legend.
   6. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, unless otherwise indicated in finish legend. Provide shapes as follows, unless otherwise indicated, selected from manufacturer's standard shapes:
      a. Base for Thinset Mortar Installations: Straight.
      b. Wainscot Cap for Thinset Mortar Installations: Surface bullnose.
      c. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
      d. External Corners for Thinset Mortar Installations: Surface bullnose.
      e. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide metal transition between adjacent floor finishes.

2.5 FLOOR UNDERLAYMENT

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
   1. See Division 03 for products to be installed in this Section.

B. Provide floor underlayment below all tiles that are more than 457mm (18 inches) long in any direction. Pour floor underlayment to provide a minimum slope of 3/16 inch in 10’-0” and a maximum slope of 1/32” in 1’- 0”. Install underlayment according to manufacturer’s guidelines and before waterproofing and crack isolation membranes.
   1. Compressive Strength: Minimum of 24.13 MPa (3,500 psi) @ 28 days per modified ASTM C109.

2.6 WATERPROOF AND CRACK ISOLATION MEMBRANES

A. Waterproof Membrane: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
   1. Vapor Permeance: Maximum 0.5 perms; ASTM E 96, Procedure E.

B. Crack Isolation Membrane: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

C. Where crack isolation and waterproof membranes are indicated for the same installation, a single membrane complying with requirements for both may be acceptable.

2.7 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
      c. MAPEI Corporation.
      d. Merkrete by Parex USA Inc.
   2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
   3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

B. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
      c. MAPEI Corporation.
      d. Merkrete by Parex USA Inc.
   2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
      c. MAPEI Corporation.
      d. Merkrete by Parex USA Inc.
   2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.8 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
      c. MAPEI Corporation.
   2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products.
      b. Laticrete International, Inc.
      c. MAPEI Corporation.
   2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.9 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Blanke Corporation.
      b. Ceramic Tool Company, Inc.
      c. Schluter Systems L.P.

B. Metal Safety Clips: Stainless steel clip support installed on the back of slabs in conjunction with thin-set and used as a secondary mechanical support system.
   1. Manufacturers: Subject to compliance with requirements, provide the following product, or approved equal:
      a. Raimondi; RIA-FIX.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.10 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 "Joint Sealants."

B. Ensure sealant can physically and chemically withstand environmental conditions normally expected a installation areas.
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
   2. Ensure sealant is chemically compatible with tile, mortar, and grout.
   3. Joint Backing: Closed cell foam polyethylene

C. Install sealants in compliance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" and as follows:
   1. Room perimeter according to TCNA.
   2. Base/Cove Sealant Joint Location:
      a. Square: Install unshaped base tile (usually the wall or floor tile) such that the wall base overlaps the floor tile and a continuous perimeter sealant joint is installed between the floor tile and the edge of the wall tile.
      b. Flush: Install shaped base such that the top of the floor lip is aligned with the top of the floor tile and a continuous perimeter sealant joint is installed between the floor tile and the edge of the base tile lip.
      c. Thin-Lip: Not allowed.
   3. Door and Window Frames: Install sealant joint in lieu of grout joint between metal frames and tile surfaces.

D. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.
      b. Tile floors consisting of tiles 8 by 8 inches or larger.
      c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch (1.5 mm).
2. Pressed Floor Tile: 3/8 inch (10 mm).
3. Glazed Wall Tile: 1/16 inch (1.5 mm).
4. Large Format Tile: 2 mm to 3 mm.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, according to TCNA and this specification. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
1. Install vertical metal edge strips at outer corners of tiled walls.

K. Grout Sealer: Apply grout sealer to cementitious grout joints specified in this Section according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 THRESHOLD AND TRANSITION SCHEDULE

A. Thin Set Floor Tile Transitions: Stainless Steel unless otherwise noted in the Drawings and Finish Schedule.
   1. Level Transition: Schluter-SCHIENE or equal.
   2. Minor Sloped Transition: Schluter-RENO-TK or equal.
   3. Larger Sloped Transition: Schluter-RENO-U or equal.
   4. Expansion or Control Joint edges: Schluter-SCHIENE or equal.
   5. Decorative Accents: Schluter-DECO or equal.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation: TCNA F113; thinset mortar, for slab-on-grade installations unless otherwise indicated.
      a. Thin-Set Mortar: Latex- portland cement mortar, unless otherwise indicated.
         1) Large-Format Tile: Medium-bed, latex- portland cement mortar.
      b. Grout: High-performance sanded, unless otherwise indicated.
         1) High-performance unsanded grout for joints less than 1/8-inch wide.
   2. Tile Installation: TCNA F122; thinset mortar on waterproof membrane, for areas subject to moisture (e.g. toilet rooms, food preparation areas), and areas subject to direct wetting (e.g. showers).
      a. Thin-Set Mortar: Latex- portland cement mortar, unless otherwise indicated.
         1) Large-Format Tile: Medium-bed, latex- portland cement mortar.

b. Grout: High-performance sanded, unless otherwise indicated.
1) High-performance unsanded grout for joints less than 1/8-inch wide.

3. Tile Installation: TCNA F131; water-cleanable, tile-setting epoxy; epoxy grout, where indicated.
a. Grout and Tile Setting: Water-cleanable epoxy grout.

B. Interior Wall Installations, Metal Studs or Furring:
1. Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units.
a. Thinset Mortar: Latex-portland cement mortar.
b. Grout: High-performance sanded, unless otherwise indicated.
1) High-performance unsanded grout for joints less than 1/8-inch wide.
2. Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
a. Thinset Mortar: Latex-portland cement mortar.
b. Grout: High-performance sanded, unless otherwise indicated.
1) High-performance unsanded grout for joints less than 1/8-inch wide.

C. Shower Wall Installations, Metal Studs or Furring:
1. Ceramic Tile Installation: TCNA B412; thinset mortar on cementitious backer units.
a. Thinset Mortar: Latex-portland cement mortar.
b. Grout: High-performance sanded, unless otherwise indicated.
1) High-performance unsanded grout for joints less than 1/8-inch wide.
2) Grout and Tile Setting: Water-cleanable epoxy grout.
3) Consider epoxy grout.

D. Shower Receptor and Wall Installations:
1. Ceramic Tile Installation: TCNA B415; thinset mortar on waterproof membrane over cementitious backer units.
a. Thinset Mortar: Latex- portland cement mortar.
b. Grout: High-performance sanded, unless otherwise indicated.
1) High-performance unsanded grout for joints less than 1/8-inch wide.
2) Grout and Tile Setting: Water-cleanable epoxy grout.
3) Consider epoxy grout.

END OF SECTION

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustical tiles for ceilings.
   2. Concealed suspension systems.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
   2. Concealed Suspension-System Members: 6-inch-long Sample of each type.
   3. Exposed Moldings and Trim: Set of 6-inch-long Samples of each type and color.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension-system members.
   2. Method of attaching hangers to building structure.
      a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL TILES, GENERAL

A. Source Limitations:
   1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL TILES (ACT1, ACT2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on the Finish Schedule on the Drawings by Armstrong World Industries, Inc., or comparable product by one of the following:
   1. CertainTeed Corp.
   2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Color: White as indicated on Drawings.

C. LR: Not less than 0.81.

D. NRC: Not less than 0.50.

E. CAC: Not less than 35.

F. Edge/Joint Detail: Beveled, tegular.

G. Thickness: As indicated on Drawings.

H. Modular Size: 24 inches by 24 inches as indicated on Drawings.

I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.5 METAL SUSPENSION SYSTEM <Insert drawing designation>

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. ArmstrongWorld Industries, Inc.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.
1. Structural Classification: Intermediate -duty system.
2. Access: Upward and end pivoted or side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
a. Initial Access Opening: In each module, As indicated on Drawings.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Armstrong World Industries, Inc., Axiom.
2. Pittcon Industries, Perimeter Trims.
3. CertainTeed Corp.
4. Chicago Metallic Company LLC, a division of ROCKFON.
5. Fry Reglet Corporation.
6. Gordon, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips and complying with seismic design requirements and the following:
   1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
   2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide the following:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.
   2. Acoustical Sealant for Concealed Joints:
      a. Henkel Corporation; OSI Sealants Pro-Series SC-175 Rubber Base Sound Sealant.
      b. Pecora Corporation; AIS-919.
      c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
   2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

2.8 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

B. Staples: 5/16-inch-long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   8. Do not attach hangers to steel deck tabs.
   9. Do not attach hangers to roof deck. Attach hangers to structural members.
   10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
1. Compliance of seismic design.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 09 61 13 - FLOOR SEALERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating liquid concrete floor treatment for the following locations:
   1. Areas indicated on the Drawings.
   2. Areas indicated in the Finish Schedule.
   3. Exterior concrete concourses.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for concrete slabs.
   2. Section 03 35 43 "Polished Concrete Finishing" for penetrating liquid that is part of a stained and mechanically polished floor treatment system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor sealers to include in maintenance manuals. Include the following:
   1. Methods for maintaining floor sealers, including cleaning and stain-removal products.
   2. Precautions for cleaning materials and methods that could be detrimental to floor sealers.

1.6 QUALITY ASSURANCE

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

B. Mockups: Apply floor sealer to set quality standards for materials and execution.
   1. Size: 100 sq. ft. of each type of substrate to demonstrate surface preparation, finish, and standard of workmanship.
      a. The Owner shall be given the opportunity to accept or reject the slip resistance of the sealed concrete prescribed by the Owner’s insurance and legal counsels.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Demolish and remove approved mockups at the completion of the project.

PART 2 - PRODUCTS

2.1 FLOOR DENSIFIERS (SC3, SC4)

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Curecrete Distribution Inc.; Ashford Formula.
   2. Dayton Superior Corporation; Sure Hard Densifier J17.
   3. Euclid Chemical Company (The), an RPM company; Eucosil.
   4. L&M Construction Chemicals, Inc.; Seal Hard.

B. Performance Requirements:
   1. VOC Content: Sealer shall have a VOC content of 0 g/L.
   2. Abrasion Resistance to Revolving Disks: At least a 30% improvement over untreated samples when tested in accordance with ASTM C779.
   3. Surface Adhesion: At least a 20% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
   4. Hardening: As follows when tested in accordance with ASTM C39:
      a. After 7 Days: An increase of at least 35% over untreated samples.
      b. After 28 Days: An increase of at least 33% over untreated samples.
   5. Coefficient of Friction: Minimum 0.8 dry, 0.65 wet when tested in accordance with ASTM C1028.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare floor according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not use frozen material. Thaw and agitate prior to use.

3.2 APPLICATION

A. Apply penetrating liquid floor treatment according to manufacturer's written instructions.
   1. 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.
   2. Keep surface wet with sealer for manufacturer’s minimum soak-in period without allowing it to dry or become slippery.

B. Protect installed floors during construction and until chemical reaction process is complete. Clean up spills during construction. Do not allow construction debris to remain on treated floor.

END OF SECTION

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. In areas where both base and transitions strips are located, provide base and transition strips from same manufacturer to ensure color match.

2.2 THERMOSET-RUBBER BASE (RB1)

A. Basis-of-Design Product: Refer to the Finish Legend in the Drawings. Subject to compliance with requirements, provide product indicated on Finish Legend by Roppe Corporation, or comparable product by one of the following:
   1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   2. Flexco.
   3. Johnsonite; A Tarkett Company.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
   1. Style and Location:
      a. Style A, Straight: Provide in areas with carpet.
      b. Style B, Cove: Provide in areas with resilient flooring.
      c. Style C, Butt to: Provide in areas indicated.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Cut lengths 48 inches long.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As indicated by manufacturer's designations, refer to Finish Schedule.

2.3 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   2. Flexco.
   3. Johnsonite; A Tarkett Company
   4. Roppe Corporation, USA.
   5. VPI, LLC, Floor Products Division.

B. Description: Rubber nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, and transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.
   1. Unless indicated otherwise, match resilient accessory to adjacent higher surface material.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 65 36 - STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conductive, solid vinyl floor tile.

B. Related Requirements:
   1. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to static-control resilient flooring including, but not limited to, the following:
      a. Examination and preparation of substrates to receive static-control resilient flooring.
      b. Installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of static-control resilient flooring. Include floor-covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.
   2. Show locations of inscribed maintenance tiles.
   3. Submit grounding diagram showing location of grounding strips and connections.

C. Samples for Initial Selection: For each type of static-control resilient flooring.

D. Samples for Verification: For each type of static-control resilient flooring, of size indicated below:
   1. Floor Tile: 6-by-9-inch units.
   2. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Product Schedule: For static-control resilient flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for static-control resilient flooring.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of static-control resilient flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for static-control resilient flooring and seaming method.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for static-control resilient flooring including resilient base and accessories.
      a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 50 deg F or more than 90 deg F.
   1. Floor Tile: Store on flat surfaces.

1.9 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive static-control resilient flooring during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during static-control resilient flooring installation.

D. Close spaces to traffic for 48 hours after static-control resilient flooring installation.

E. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Conductive Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
   1. Electrical Resistance: Test per ASTM F 150 with 500-V applied voltage.
      a. Average greater than 25,000 ohms and less than 1 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).

b. Average greater than 25,000 ohms with no single measurement less than 10,000 ohms when installed floor coverings are tested surface to ground.
2. Static Generation: Less than 100 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
3. Static Decay: 5000 to zero V in less than 0.03 seconds when tested per FED-STD-101C/4046.1.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 CONDUCTIVE RESILIENT FLOOR COVERINGS (SDT1)

A. Conductive, Solid Vinyl Floor Tile : ASTM F 1700, Class I (monolithic), Type A (smooth surface).
1. Products: Subject to compliance with requirements, provide Tarket, Inc,, iQ Toro SC, as indicated on the Finish Schedule on the Drawings; or comparable products by one of the following manufacturers:
a. 3M Specified Construction Products Division; 3M Static Control Conductive Floor Tile.
b. American Biltrite (Canada); Electrotile Conductive CVT.
c. Flexco; Conductive Solid Vinyl Tile (SP).
d. Forbo Industries, Inc; Colorex EC Conductive Vinyl Tile.
e. Gerflor; Mipolam Technic EL 5.
f. Johnsonite; A Tarkett Company; Toro SC.
g. Julie Industries, Inc; StaticSmart ESD Vinyl Tile.
h. LG Hausys; Static Pulse Conductive Tile.
i. Polyflor, Ltd., Distributed by Gerbert Limited; Finesse EC or Polyflor EC.
j. Roppe Corporation, USA; StatProtect Conductive Solid Vinyl Floor Tile.
k. VPI, LLC, Floor Products Division; Conductile.
2. Thickness: In manufacturer's standard thickness, but not less than 0.08 inch.
3. Size: 24 by 24 inches.
4. Seaming Method: Standard.
5. Colors and Patterns: As indicated by manufacturer's designations, refer to Finish Schedule.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.

D. Seamless-Installation Accessories:
1. Heat-Welding Bead: Solid-strand product of manufacturer for heat welding seams.
a. Color: Match floor covering.
2. Chemical-Bonding Compound: Product of manufacturer for chemically bonding seams.

E. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

F. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion or static-control characteristics of floor coverings.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions and with oversight by manufacturer's representative to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative-humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative-humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.
   1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.3 INSTALLATION, GENERAL

A. Install static-control resilient flooring according to manufacturer's written instructions and with oversight by manufacturer's representative.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.

C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install static-control resilient flooring on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of static-control resilient flooring installed on covers. Tightly adhere static-control resilient flooring edges to substrates that abut covers and to cover perimeters.

G. Adhere static-control resilient flooring to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:
1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor-covering surfaces.
2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor-covering surfaces.

3.4 FLOOR-TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
1. Lay floor tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

D. In each space where conductive, solid vinyl floor tile is installed, install maintenance floor tile identifying conductive floor tile in locations approved by Architect.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.
1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.
2. Arrange for testing of static-control resilient flooring before and after performing floor polish procedures.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.

B. Perform the following operations immediately after completing static-control resilient flooring:
1. Remove static-control adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. Do not wax static-control resilient flooring.
   2. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties; ensure static-control resilient flooring surfaces are free from soil, static-control adhesive, and surface blemishes.
      a. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces static-control resilient flooring's effectiveness for static control.

D. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resinous flooring systems. This section controls the chemistry of the resinous flooring system to be installed. The Finish Legend controls the color of the resinous flooring system.
   1. MMA.

B. Related Sections:
   1. Section 09 29 00 “Gypsum Board” for cementitious backer bands used behind resinous flooring cove base.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Shop Drawings: Include installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
   1. Patterns and colors.
   2. Transitions or divider strips.
   3. Control-joints.

C. Samples for Verification: For each resinous flooring system and exposed finish required, 12 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's on-site technical representative.

B. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

C. Material Certificates: For each resinous flooring component, from manufacturer.

D. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation.

C. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 200 square feet of floor area selected by Architect.
      a. Include 96-inch length of integral cove base with inside and outside corner.
   2. Simulate finished lighting conditions for Architect's review of mockups.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in The Department of Justice’s 2010 ADA Standards, and IBC and ICC/ANSI A117.1 or other locally enforced accessibility standards, Owner and the Owner’s insurance and legal counsels, for slip resistance of flooring.

2.2 MANUFACTURERS

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.3 RESINOUS FLOORING (FT1)

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in the Finish Legend, BASF Construction Chemicals - Construction Systems, MasterTop SRS 1851 CF; or comparable product by one of the following:
      a. Key Resins
      b. Sika Corporation.
      c. Stonhard, Inc.
      d. Res-Tek.

B. System Characteristics:
   1. Color and Pattern: As indicated on the Finish Legend.
   2. Wearing Surface: Textured for slip resistance.
   3. UV-Stable.
   4. Thermal Shock Resistant: 180 degrees F. minimum.
   5. Cure Rate @ 68 F: 30-60 minutes.
   6. Installation Temperature: 32 degrees F. minimum; 90 degrees F. maximum.
   7. Overall System Thickness: 3/16 inch, nominal.

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
   1. Formulation Description: 100 percent solids.

D. Body Coats:
   1. Resin: Methyl methacrylate.
   2. Formulation Description: 100 percent solids.
   3. Filler: Manufacturer's standard filler component.
   4. Type: Pigmented.
   5. Application Method: Self-leveling slurry with broadcast aggregates.
      a. Cove Bases: Manufacturer's non-self-leveling formula and filler to create cove bases.
   6. Number of Coats: One.
   7. Thickness of Coats: 1/8 inch.
   8. Aggregates: Vinyl flakes.

E. Topcoats: Sealing or finish coats.
   1. Resin: Methyl methacrylate.
   2. Formulation Description: 100 percent solids.
   3. Type: Clear, MasterTop SRS 71TC Colorless Topcoat.
   4. Antimicrobial Additive: Manufacturer's standard.
   5. Non-slip Aggregate:
      a. Glass beads (25-45 sieve) as required to meet field sample testing.
      b. Aluminum Oxide, 36 grit.
   6. Number of Coats: Two, or more as required by approved finish texture.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   1. Compressive Strength: 6000 psi minimum according to ASTM C 579.
   2. Tensile Strength: 1450 psi minimum according to ASTM C 307.
   3. Water Absorption: 0.04 percent maximum according to ASTM C 413.
   4. Hardness: 70, Shore D according to ASTM D 2240.

G. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 543, Procedure A, for immersion, or ASTM C 267 for immersion, in the following reagents for no fewer than seven days:
   1. Effect of weak acids: none.

2. Effect of strong acids: slight.
3. Effect of alkalis: none.
4. Effect of salt solutions: none.
5. Effect of oil, grease: none.
6. Effect of sunlight (UV radiation): none.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions and this specification for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Roughen concrete substrates as follows:
      a. Shot-blast surfaces to CSP of 4 to 5 with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
         1) All surface and embedded accumulations of paint, toppings, hardened concrete layers, laitance, power trowel finishes, and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a profile similar to 40 grit sandpaper and exposing the upper fascia of concrete aggregate.
      b. Floor areas inaccessible to the mobile blast cleaning machines shall be mechanically abraded to the same degree of cleanliness, soundness, and profile using vertical disc scarifiers, starwheel scarifiers, needle guns, scabblers, or other suitably effective equipment.
   2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
   3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
      a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
      b. Plastic Sheet Test: ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
   4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests including bond tests recommended by manufacturer. Proceed with application only after substrates pass testing.
      a. If no amount or kind of surface preparation produces satisfactory bond tests, the applicator shall report that to the Owner, Engineer, and Manufacturer.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
   1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base to match flooring. Round internal and external corners.
   1. Integral Cove Base: 4 inches high.
   2. Surface Preparation:
      a. Install over 1/2” cement board substrate, cut to the desired height of the cove base needs to be installed. The top of the backer board should be cut at a 45° angle to create a “beveled” edge.
      b. Fasten cement board to wall substrate using a high grade construction adhesive as well as counter sunk screws.
   3. System Description:
      a. Cove base shall be installed according to manufacturer’s recommendations and shall be one of two systems:
         1) MasterTop 1815 SRS CB or MasterTop 1815 SRS RG cove base consisting of “spooned in” radius and brush on body coat.
         2) Trowel-On Cove Base consisting of a trowel applied radius/base mix with a termination strip installed at the top of the base.
      b. Cove base will receive a broadcast and top coat consistent with flooring system.

D. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.
   1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

E. Non-slip Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated. Slip resistant aggregate is not required on cove bases.

F. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Technical Representative: Engage an authorized technical representative of manufacturer to observe and inspect preparation and installation on site.

B. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

C. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Carpet Tile.

B. Related Requirements:
   1. Section 01 32 00 “Construction Progress Documentation” for long lead and scheduling requirements.
   2. Section 09 30 13 “Tile” for transition strips between tile and carpet.
   3. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

C. Carpet could have a long lead time. Contractor is strongly urged to address this situation at the beginning of the Project and to incorporate the time line into the Project Schedule.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to carpet installation including, but not limited to, the following:
      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
   2. Carpet type, color, and dye lot.
   3. Locations where dye lot changes occur.
   4. Seam locations, types, and methods.
   5. Type of subfloor.
   6. Type of installation.
   7. Pattern type, repeat size, location, direction, and starting point.
   8. Pile direction.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Yarn samples: Submit pom or yarn samples prior to carpet sample.
   2. Carpet: 30 cm (12-inch)- square Sample.

D. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups at locations and in sizes shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.10 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Refer to the Finish Legend. Subject to compliance with requirements, provide product indicated on Finish Legend or comparable product by one of the following:
1. Atlas Carpet Mills, Inc.
2. Bentley Prince Street, Inc.
3. Interface, LLC.
4. J&J Invision; J&J Industries, Inc.
5. Mannington Mills, Inc.
6. Masland Contract; Dixie Group, Inc. (The).
7. Milliken | Constantine Commercial Carpet.
8. Mohawk Group (The); Mohawk Carpet, LLC.
9. Patcraft; a division of Shaw Industries, Inc.
10. Tandus; a Tarkett company
11. Approved equal.

2.2 CARPET TILE (CA1)

A. Carpet:
1. Refer to the Finish Legend for each Basis of Design product selection details.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 3 mm (1/8 inch wide or wider, and protrusions more than 0.7 mm (1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. General: Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
   1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Carpet Tile Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

H. Maintain dye lot integrity. Do not mix dye lots in same area.

I. Install in pattern indicated on Drawings. Install pattern and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

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SECTION 09 72 19 – GRAPHIC WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl wall covering.

B. Related Sections:
   1. Section 09 91 23 “Interior Painting” for paint products installed on wall coverings.
   2. Section 10 14 00 “Signage” for graphic artwork, digital requirements and printing requirements for custom wallcoverings specified in this Section.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement (print proof), seams and termination points.

C. Samples: For each type of wall covering and for each color, pattern, backing, texture, and finish specified, full width by 36-inch- long in size.
   1. Print Proof: Refer to Signage Section for printing requirements for custom artwork.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.
   1. Show roll identification on schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 76 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 286.

2.2 VINYL WALL COVERING

A. Basis-of-Design Product: Refer to the Finish Legend in the Drawings. Subject to compliance with requirements, provide the product listed in the Finish Legend or comparable product by one of the following:
   1. Koroseal Digital Surfaces.
      a. Basis of Design.
   2. Dreamscape.

B. Description: See Signage Detail Manual for product detail.

C. Provide mildew-resistant products in rolls from same production run and complying with the following:
   1. FS CCC-W-408D and CCC-W-408-D for Type II, Medium-Duty products.
   2. ASTM F 793 for strippable wall coverings.
      a. Category: II, Decorative with Medium Serviceability.

D. Width: 21 oz. per linear yard 54 inches.

E. Backing: Osnaburg fabric.
   1. Fiber Content: Polycotton.
   2. Basis of Design: Koroseal, Linen backing.

F. Colors, Textures, and Patterns: Artwork to be provided by Architect.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 91 23 "Interior Painting" for Level 5 finish and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Field verify all wall locations that Level 5 finish standard have been met.

C. Review Signage specification for field verification for wall size, templating and provision of digital templates.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items. Wallcovering contractor to reinstall all hardware and hardware accessories that they remove.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL-COVERING INSTALLATION

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Install wallcovering in same order according to Signage Template.

C. Install wall covering without lifted or curling edges and without visible shrinkage.

D. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

E. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

F. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

G. Install metal corner guards according to 10 26 00 “Wall and Door Protection” section.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

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SECTION 09 77 23 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, fabric wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include fabric panels and mounting indicated.

B. Shop Drawings: For panel assembly and installation.
   1. Include plans, elevations, sections, and mounting devices and details.
   2. Indicate panel edge profile and core materials.

C. Samples for Initial Selection: For each type of fabric facing.
   1. Include Samples of hardware and accessories involving color or finish selection.

D. Samples for Verification: For the following products:
   1. Fabric Panel: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
   2. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of panel.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fabric Panel: For each fabric panel, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd.
   2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
   1. Build mockup of typical wall area 48 inches wide by full height. Include intersection of corners and perimeters.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install panels until a permanent level of lighting is provided on surfaces to receive the panels.

C. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Fabric panel warping, sagging, or distorting.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fabric wall panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 FABRIC WALL PANELS (SP1)

A. Fabric-Wrapped Wall Panel : Manufacturer's standard panel construction .
   1. Basis-of-Design Product: Subject to compliance with requirements, provide 3form, Sola Felt; or comparable product by one of the following:
      a. Acoustical Panel Systems (APS, Inc.).
      b. Acoustical Solutions, Inc.
      c. Armstrong World Industries.
      d. AVL Systems, Inc.
      e. Benton Brothers Solutions, Inc.
      f. Brejtfus Acoustical Interiors.
      g. Conwed Designscape; an Owens Corning company.
      h. Decoustics Limited; a Saint Gobain company.
      i. Essi Acoustical Products.
      j. Golterman & Sabo.
      k. Lamvin, Inc.
      l. MBI Products Company, Inc.
      m. Panel Solutions, Inc.
      n. Perdue Acoustics, Inc.
      o. Pinta Acoustic, Inc.
      p. Proudfoot Company, Inc. (The).
      q. Sound Concepts Canada, Inc.
      r. Sound Management Group LLC.
      s. Tectum Inc.
      t. Wall Technology, Inc.; an Owens Corning company.
      u. Wenger Corporation.
      v. Working Walls, Inc.
   2. Panel Shape: Flat, as indicated on Drawings.
   3. Mounting: Back mounted with manufacturer's standard adhesive, secured to substrate.
   4. Reveals between Panels: Recessed or flush reveals as indicated on Drawings.
   5. Nominal Overall Panel Thickness: 1/4 inch.
      a. Weight: 0.30 lb./sq.ft. (1.5 kg/m2).
   6. Panel Width: As indicated on Drawings.
   7. Panel Height: As indicated on Drawings.
   8. Color: As indicated on Finish Schedule on Architectural Drawings.

2.4 MATERIALS

A. Panel Materials: Manufacturer's standard.
   1. Polyethylene Teraphthalate (PET) pellets extruded into thin fibers, compressed in layers to create sound-absorbing panels.

B. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:
   1. Adhesives: As recommended by panel manufacturer and with a VOC content of 70 g/L or less.

2.5 FABRICATION

A. Materia: Panels shall be free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.

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

3.2 INSTALLATION

A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Remove surplus materials, rubbish, and debris resulting from wall panel installation, upon completion of the Work, and leave areas of installation in a neat and clean condition.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16 inch wide from reveal line in 48 inches, noncumulative.

3.4 CLEANING AND PROTECTION

A. Remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

C. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure wall panels are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
   2. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. EPA VOC Regulations: All products supplied under this specification section for the locations listed below must be compliant with the VOC limits set in the following districts.
   1. Oklahoma: Follow USEPA AIM VOC rules.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Carboline Company.
2. International Paint, Devoe Coatings; a brand of AkzoNobel.
3. PPG Protective & Marine Coatings.
4. Sherwin-Williams.

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

C. Colors: Colors indicated by manufacturers' designations in the Finish Schedule Legend are basis of design for color-matching other manufactures' paint systems.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMUs): 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.

C. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 6, "Commercial Blast Cleaning."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Aluminum Substrates: Remove loose surface oxidation.

I. Wood Substrates:
   1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
   3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
   4. Paint entire exposed surface of window frames and sashes.
   5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed to view:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.

d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces: 2 coats Zero VOC acrylic semigloss, over high performance acrylic concrete/masonry primer.
1. Carboline Company.
2. International Paint, Devoe Coatings; a brand of AkzoNobel.
3. PPG Protective & Marine Coatings.
4. Sherwin-Williams.

B. Concrete Substrates, Horizontal Surfaces:
1. Hazard and Safety Striping: Epoxy Non-Slip Deck Coating System.
a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Epoxy deck coating (slip resistant).
1) American Safety Technologies; an ITW Polymers Coatings North America brand; AS-150 HAPS Free.
2) PPG Industries, Inc.; MegaSeal NSP.
3) Rust-Oleum Corporation; AS5400 System.
d. Color: As indicated on Drawings.
e. Width: As indicated on Drawings.

C. CMU Substrates: 2 coats Zero VOC acrylic semigloss, over high performance acrylic concrete/masonry primer.
1. Carboline Company
2. International Paint, Devoe Coatings; a brand of AkzoNobel.
3. PPG Protective & Marine Coatings.
4. Sherwin-Williams.

D. Miscellaneous Steel Substrates: Rust-inhibitive acrylic universal primer, and 2 coats Zero VOC acrylic semigloss.
   1. Carboline Company
   2. International Paint, Devoe Coatings; a brand of AkzoNobel.
   3. PPG Protective & Marine Coatings.
   4. Sherwin-Williams.

E. Shop-Primed Structural Steel Substrates: High build polyamide epoxy intermediate coat with 1 coat semigloss high-build acrylic polyurethane finish.
   1. Carboline Company
   2. International Paint, Devoe Coatings; a brand of AkzoNobel.
   3. PPG Protective & Marine Coatings.
   4. Sherwin-Williams.

F. Galvanized-Metal Substrates, Except Railings: High solids, high build, polyamide epoxy prime coat, with high performance acrylic semigloss.
   1. Carboline Company
      a. Primer: Carboguard 888.
      b. Topcoats: 2 coats, Carbocrylic 3359.
   2. International Paint, Devoe Coatings; a brand of AkzoNobel.
      a. Primer: Devran 201H.
      b. Topcoats: 2 coats, Devcryl 1449.
   3. PPG Protective & Marine Coatings.
      a. Primer: Amercoat 385.
      b. Topcoat(s): 2 coats, Pitt-Tech Plus Int./Ext. Semi-Gloss DTM Industrial Enamel.
   4. Sherwin-Williams.
      a. Primer: Recoatable Epoxy Primer.
      b. Topcoats: 2 coats, Sher-Cryl High Performance Acrylic.

G. Galvanized-Metal Railings: High solids, high build, polyamide epoxy prime coat, with semigloss aliphatic acrylic polyurethane finish coat.
   1. Carboline Company
      a. Primer: Carboguard 888.
      b. Topcoats: 2 coats, Carbothane 133LH.
   2. International Paint, Devoe Coatings; a brand of AkzoNobel.
      a. Primer: Devran 201H.
      b. Topcoats: 2 coats, Devthane 378.
   3. PPG Protective & Marine Coatings.
      a. Primer: Amercoat 385.
      b. Topcoats: 2 coats, Amershield.
   4. Sherwin-Williams.
      a. Primer: Recoatable Epoxy Primer.
      b. Topcoats: 2 coats, Hi-Solids Polyurethane, B65-350 Series B60V30.

H. Aluminum Substrates: Acrylic universal primer, and 2 coats Zero VOC acrylic semigloss.
   1. Carboline Company
   2. International Paint, Devoe Coatings; a brand of AkzoNobel.
   3. PPG Protective & Marine Coatings.
   4. Sherwin-Williams.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
2. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.
3. Section 09 29 00 “Gypsum Board” for painted finishes on non-tiled substrates in wet areas.
4. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
5. Section 09 96 00 "High-Performance Coatings" for shop priming and shop finishing structural steel.

1.2 DEFINITIONS

A. Gloss Level 1 (Flat): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2 (Velvet): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5 (Semigloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7 (High Gloss): More than 85 units at 60 degrees, according to ASTM D 523.

H. Areas Subject to Moisture and Food Preparation: These spaces are those that have permanent plumbing connections and appliances. These include, but are not limited to, toilet rooms connected to shower areas, janitor’s closets, training rooms, concession stands, commissaries, kitchens, and at Wash Bay side of wall separating Restroom 01.15.07 and Fire Pump Room 01.15.08 from east Wash Bay area 01.15.09, along grid K. These areas require epoxy painting systems.
1. Toilet rooms consisting solely of toilets and sinks are not included in this definition.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.

4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. EPA VOC Regulations: All products supplied under this specification section for the locations listed below must be compliant with the VOC limits set in the following districts.
   1. Oklahoma: Follow USEPA AIM VOC rules.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. PPG Paints

3. Sherwin Williams

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

C. Colors: As indicated in a color schedule.

2.3 PAINT, PRODUCTS

A. See Interior Painting Schedule for full coating instructions based on substrate.

B. Block filler: Provide at all new concrete and concrete masonry walls to be painted.
   1. Benjamin Moore: Masonry Interior /Exterior Hi-Build block filler
   2. PPG Paints: Speedhide Interior/Exterior Concrete Block & Masonry Filler.
   3. Sherwin Williams: PrepRite block filler.

C. Epoxy Block filler: Provide at all new concrete and concrete masonry walls to receive epoxy top coat.
   1. Benjamin Moore: M31/M32 Waterborne or Corotech Waterborne V163.
   2. PPG Paints: Amerlock 400 BF.
   3. Sherwin Williams: Kem Cati-Coat.

D. Primer: Provide at all new wall construction as indicated in Interior Painting Schedule at the end of this Section.
   1. Gypsum and Plaster substrates: primers to be compatible with substrate and finish coat.
      a. Benjamin Moore, Ultra Spec 500 Interior Primer.
      b. PPG Paints, SpeedHide zero VOC interior latex primer.
         1) PPG SpeedHide MaxPrime interior primer.
      c. S-W, ProMar 200 zero VOC interior latex primer.
         1) SW, Tuff Stuff interior primer.
   2. Interior Metals: primers to be compatible with substrate and finish coat.
      a. Benjamin Moore, Super Spec HP Acrylic Metal Primer.
      b. PPG Paints, Pitt-Tech Plus Industrial DTM Primer.
      c. Sherwin Williams, Pro Industrial Pro-Cryl Universal Primer.
      d. Tnemec: Tneme-Cryl primer, Series 6.

E. Acrylic Latex:
   1. Benjamin Moore, Ultra Spec 500.
   2. PPG Paints, Speedhide zero VOC.
   3. Sherwin Williams, ProMar 200 zero VOC.

F. Epoxy: waterborne, catalyzed polyamide epoxy.
   1. Benjamin Moore: Super Spec HP.
   2. PPG Paints: Aquapon.
   3. Sherwin-Williams: Pro Industrial.
   4. Tnemec:
      a. Multi-purpose Epoxy, Series 113, satin finish.
      b. Multi-purpose Epoxy, Series 287, semi-gloss.

G. Dry Fall, Interior applications.
   1. Benjamin Moore: Latex Dry Fall Flat 395.

2. PPG Paints: SpeedHide Interior Dry-fog.
3. Sherwin Williams:
   a. Low VOC Waterborne Dryfall.
   b. SprayLastic Waterborne Dryfall.

2.4 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
      a. Allow masonry to cure a minimum of 30 days prior to paint application regardless of moisture content readings.
   2. Masonry (Clay and CMUs): 12 percent.
      a. Allow masonry to cure a minimum of 30 days prior to paint application regardless of moisture content readings.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.
   5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth and complies with the Level standard specified.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Unprimed Interior Steel Substrates: Remove oil, grease, dust, dirt, rust, and loose mill scale. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. Shop Priming Preparation: SSPC-SP 7/NACE No. 4.
   2. Field Priming Preparation: SSPC-SP 11.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth. Exercise care to avoid raising nap of paper.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint exposed surfaces, except where the Finish Schedule indicates that a surface or material is not to be painted or is to remain natural. If the schedule does not indicate color or finish, match adjacent materials or surfaces.
   3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
   a. Equipment, including panelboards and switch gear.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Tanks that do not have factory-applied final finishes.
   h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. **General:** Provide the following paint systems for the various substrates, as indicated; unless noted otherwise in the Construction Documents.
   1. Pipe and Equipment Identification Schedule:
      a. Painting: Paint entire surface of pipe for mechanical and electrical services in accordance with schedule provided on mechanical and electrical drawings or contained in mechanical and electrical specifications.

B. Concrete Substrates, Nontraffic Surfaces: Not less than 2.5 mills dry, acrylic semi-gloss, over 1 coat of block filler and 1 coat of high performance acrylic concrete/masonry primer, unless otherwise indicated.
   1. Areas Subject to Moisture and Food Preparation: Not less than 3.0 mills dry, water-based 2 part catalyzed semi-gloss epoxy over 1 coat of epoxy filler and 1 coat of epoxy sealer.

C. CMU Substrates: Not less than 2.5 mills dry, acrylic semigloss, over 1 coat of block filler and 1 coat of over high performance acrylic concrete/masonry primer, unless otherwise indicated.
   1. Administrative Areas Finish Coats: Not less than 2.5 mills dry, zero VOC latex eggshell.
   2. Areas Subject to Moisture and Food Preparation: Not less than 3.0 mills dry, water-based 2 part catalyzed semi-gloss epoxy over 1 coat of epoxy filler and 1 coat of epoxy primer.

D. Miscellaneous Steel Substrates: 1 coat of rust-inhibitive acrylic universal primer, and not less than 2.5 mills dry, zero VOC acrylic semi-gloss.
   1. Include hollow metal doors and frames.

E. Structural Steel Substrates: Primer and finish coating is specified in Section 099600 “High Performance Coatings.”

F. Galvanized-Metal Substrates, Except Railings: Acrylic universal primer, and not less than 3 mills dry, zero VOC acrylic semi-gloss, see Exterior Painting for paint product.

G. Galvanized-Metal Railings: High solids, high build, polyamide epoxy prime coat, with semi-gloss aliphatic acrylic polyurethane finish coat, see Exterior Painting for paint product.

H. Aluminum Substrates: Acrylic universal primer, and not less than 3 mills dry, zero VOC acrylic semigloss.

I. Wood Substrates; Transparent Finish: Specified in Section 09 93 00 “Staining and Transparent Finishing.”

J. Gypsum Board Substrates:
   1. Walls: Not less than 2.5 mills dry, zero VOC latex eggshell over zero VOC interior latex primer.
   2. Ceilings: Not less than 2.5 mills dry, zero VOC latex flat over zero VOC interior latex primer.
   3. Epoxy: Not less than 3.0 mills dry, water-based 2 part catalyzed semi-gloss epoxy over epoxy primer.

END OF SECTION

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SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood stains and transparent finishes.

1.2 DEFINITIONS

A. Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 7 (High Gloss): More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Indicate VOC content.

B. Samples for Initial Selection: For each type of product.

C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
   1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of stain color selections will be based on mockups.
      a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. Industria Chimica Adriatica SpA (ICA); distributed by Power Process Equipment, Inc.
   3. PPG Architectural Finishes, Inc.
   4. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

A. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Stain Colors: As indicated in a color schedule.

2.3 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.
1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
1. Use applicators and techniques suited for finish and substrate indicated.

2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

A. Wood Substrates: Architectural woodwork and wood board paneling.
1. Polyurethane Varnish over Stain System:
    a. Stain Coat: Stain, semitransparent, for interior wood.
        1) Sherwin-Williams Company; Wood Classics Interior Oil Stain - 250; A49-800 Series.
    b. First Intermediate Coat: Polyurethane varnish matching topcoat.
    c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
    d. Topcoat: Varnish, interior, polyurethane, water-based, satin (Gloss Level 4).
        1) Sherwin-Williams Company; Wood Classics Waterborne Polyurethane Varnish, A68 Series, Satin.
    e. Topcoat: Varnish, interior, polyurethane, water-based, high gloss (Gloss Level 7).
        1) Sherwin-Williams Company; Wood Classics Waterborne Polyurethane Varnish, A68 Series, Gloss.

END OF SECTION

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of high-performance coating systems on the following substrates:
   1. Structural Steel Framing, exterior and exposed steel surfaces.

B. Related Requirements:
   1. Section 09 91 13 "Exterior Painting" for special-use coatings and general field painting of other exterior surfaces.
   2. Section 09 91 23 "Interior Painting" for special-use coatings and general field painting of other interior surfaces.
   3. Section 13 34 19 “Metal Building Systems” for coatings on Pre-Engineered metal buildings.

C. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied, may be specified elsewhere or referenced to this Section so that a complete system is specified and coordinated.
   1. Where surface preparation and first (prime) coat are specified in other Sections to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
   2. If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting.
   3. Concealed surfaces are generally not required to have finish-coats unless otherwise specified, but prime coat should be applied and touched up prior to concealment

1.2 DEFINITIONS

A. Gloss Level 5 (Semigloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

B. Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

C. SSPC / NACE Surface Preparation Standards:
   1. SSPC-SP6/NACE 3 – Commercial Blast Cleaning:
      a. A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter, except for staining. Staining shall be limited to no more than 33% of each square inch of surface area and may consist of light shadows, slight streaks or minor discoloration caused by stains of rust, stains of mill scale or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods. For complete instructions, refer to Joint Surface Preparation Standard SSPC-SP6/NACE 3.
   2. SSPC-SP11 – Power Tool Cleaning to Bare Metal:
      a. Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. The profile shall not be less than 1 mil. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods

specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods. For complete instructions, refer to Society of Protective Coatings Surface Preparation Specification No.11

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include VOC content, preparation requirements, and application instructions.

B. Structural Steel Coatings Procedure Manual: Prepared by manufacturer, specifying application and touch-up requirements specifically for this Project. Include the following:
1. Weather and Dew Point.
2. Method of Application (brush, roll or spray including what type of equipment).
3. Dry film thickness and time between surface preparation and application of primer.
4. Equipment cleanliness.
5. Surface preparation prior to application of each coat.
6. Drying time between primer and finish coat(s) and after application of finish coat.
7. Pot Life.
8. Thinning.
9. General application techniques for critical areas to be coated.
10. Maintenance and repair procedures providing a systematic process for inspection, record keeping and observation, coating application, and repair procedures.
11. Types and extent of failures requiring repairs.

C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
2. Final approval of color selections will be based on mockups.
a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. EPA VOC Regulations: All products supplied under this specification section for the locations listed below must be compliant with the VOC limits set in the following districts.
1. Oklahoma: Follow USEPA AIM VOC rules.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, from systems listed in the Schedule at the end of this Section:
   1. Akzo Nobel.
   2. Carboline Company.
   3. International Protective Coatings; an AkzoNobel Brand.
   4. PPG Protective & Marine Coatings.
   5. Sherwin-Williams Company Protective & Marine Coatings.
   6. Tnemec Company, Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
   3. When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.
   4. When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Engineer/Architect of any unsuitable substrate or coating conditions.
   5. Provide products of same manufacturer for each coat in a coating system.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 SURFACES NOT TO BE COATED:

A. Pre-finished metal wall panels and accessories.

B. Aluminum, stainless steel, or other non-ferrous metals.

C. Equipment name plates and testing labels.

D. Electrical equipment.

E. Plastic, rubber, or other synthetic materials.

2.4 CARBON STEEL

A. Primers:
1. Shop Primer, Organic Zinc-Rich, with Epoxy or Urethane Binder:
a. Minimum Volume Solids: 50 percent.
b. Minimum Zinc Content: 80 percent.
c. ASTM A 490 Class B Slip Coefficient.
d. Dry Film Thickness: 2.5 to 3.5 mils per coat.
2. Touch-Up Primer: Manufacturer's recommended primer for field touchup over marginally prepared rusted steel, compatible with shop primer and finish coat.
a. Minimum Recoat Window: 12 months.
b. Minimum Volume, solids: 60 percent.
c. Dry Film Thickness: 5 mils.

B. Top Coat: Polyurethane Coating.
1. Polyurethane, High-Build Acrylic Polyurethane, Pigmented, Semigloss or Gloss (Gloss Levels 5 or 6):
a. Minimum Volume Solids: 60 percent.
b. Abrasion Resistance: ASTM D 4060; Not more than 75 mg loss after 1000 cycles.
c. Adhesion: ASTM D 4541; Not less than 825 psi average of 3 trials.
d. Corrosion Resistance: ASTM B 117; Not more than 1/32 inch rust creepage at scribe, and none at edges after 1000 hours.
e. Dry Film Thickness: 3 to 5 mils per coat.

2.5 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

B. Steel Substrates for Shop Priming: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
      a. Minimum Surface Profile: 1.5 mils.

A. Steel Substrates for Field Touch-Up Priming: Remove rust, loose mill scale, back to sound primer. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 11/NACE No., "Power Tool cleaning to bare metal."
      a. Minimum surface profile.

B. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

C. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
   1. SSPC SP-3 Solvent Wipe for mechanically galvanized surfaces.

3.3 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.
      a. Hold back primer 6 inches from weld.

B. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions, as indicated in Structural Steel Coatings Procedure Manual submitted, and at rate recommended to provide minimum dry film thickness. Use priming methods that result in full coverage of joints, corners, edges, bolted connections, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

3.4 FINISH COATING

A. At the Contractor’s option, finish coat may be applied in the shop or in the field after erection.

B. Shop-Applied Finish Coat:
   1. Apply finish coat to primed structural steel surfaces except the following:
      a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
      b. Surfaces to be field welded.
      c. Surfaces to be high-strength bolted with slip-critical connections.
      d. Surfaces to receive sprayed fire-resistive materials.
   2. After erection, clean field welds, bolted connections, and abraded areas according to manufacturer’s instructions. Apply touch-up primer and finish coat according to manufacturer’s instructions.

C. Field-Applied Finish Coat:
   1. After erection, clean field welds, bolted connections, and abraded areas of shop paint according to manufacturer's instructions, and apply touch-up primer.
   2. Apply finish coat to primed structural steel surfaces except the following:
      a. Surfaces to receive sprayed fire-resistive materials.

3.5 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations indicated in Structural Steel Coatings Procedure Manual submitted.
   1. Use applicators and techniques suited for coating and substrate indicated.

B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.6 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Contractor shall touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.7 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

E. All off-gassing must be complete prior to substantial completion.

3.8 MAINTENANCE AND REPAIR

A. Responsibility:
   1. Contractor: Responsible for coating maintenance and repair established in the Structural Steel Coatings Procedure Manual prepared for this Project, from the date of Notice to Proceed to Final Completion of the Contract.
   2. Owner: Responsible for coating maintenance and repair established in the Structural Steel Coatings Procedure Manual prepared for this Project, after Final Completion of the Contract.

3.9 HIGH-PERFORMANCE COATING SCHEDULE

A. Structural Steel Framing Substrates, including exposed surfaces of metal decking:
   1. Pigmented Polyurethane over Organic Zinc-Rich Primer System:
      a. Carboline Company:
         1) Shop Primer: Carbozinc 859.
         2) Finish Coat: Carbothane 133 MC.
      b. International Protective Coatings; an AkzoNobel Brand:
         1) Shop Primer: Interzinc 315.
         2) Finish Coat: Interthane 870UHS.
         ****** OR ******
         3) Shop Primer: Catha-Coat 315.
         4) Finish Coat: Devthane 378.
      c. PPG Protective & Marine Coatings:
         1) Shop Primer: Ameron 68HS.
         2) Finish Coat: Amershield.
      d. Sherwin-Williams Company Protective & Marine Coatings:
         1) Shop Primer: Zinc-Clad IIIHS.
         2) Finish Coat: Acrolon 218 HS Acrylic Polyurethane.
      e. Tnemec Company, Inc:
         1) Shop Primer: Series 90-97 Tneme-Zinc.
         2) Finish Coat: Series 1075U, Endura-Shield II.

END OF SECTION

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SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes engineering, furnishing, and installing the following signage and support systems:
   1. Aluminum signs and supports.
   2. Dimensional characters and icons.
   3. Room identification signs.
   4. Wayfinding signs.
   5. Branding signage and graphics.

B. Related Requirements:
   1. Sign Location plans for the signage location.
   2. “Signage Detail Manual” for the signage design details. Contractor note: “Signage Detail Manual” is under separate cover.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide signs and anchorage points capable of withstanding the effects of gravity, wind (up to 110 mph), snow, and seismic loads and stresses, as indicated in the General Notes of the Structural Drawings determined according to the local building code and authorities having jurisdiction.
   1. Deflection of signs and supports in vertical and horizontal direction shall be no greater than 1/360 of clear span or 3/4 inch, whichever is smaller.

B. Thermal Movements: Provide post and panel signs that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions relative to materials, dimensions of individual components, profiles, and finishes for each type of sign material required.

B. Shop Drawings: Submit shop drawings for fabrication and erection of supports and signs. Include plans, elevations, and large scale details of sign wording and lettering layout. Include large scale sections of typical members and other components. Show fabrication joints and fasteners. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
   1. For signage required to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Submit sign layouts for verification, including outline of sign face, character spacing, line spacing, and copy composition. Submit sign layouts for each sign type.
   3. Engineering, fabrication, and construction schedule.
   4. For signs supported by or anchored to permanent construction, provide setting drawings, full-size spacing templates, and directions for installation of anchor bolts and other appropriate anchors to be installed.
   5. Submit drawings in 11 inch by 17 inch format unless otherwise requested by the Architect.

C. Samples: Submit three 6-inch square samples of each sign material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics. One sample set to be kept by Architect, contractor, and client as a record to later match against items in the field.
   1. Submit full-size sample units, if requested by Architect. Acceptable units may be installed as part of the work.

D. Provide written documentation that the braille translation included on the manufacturer's signage provided in this section has been evaluated by a Braille translator certified in writing by either The Library of Congress or the National Federation for the Blind, and is, in their opinion, correct and compliant with ADAAG.

E. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals. Include manufacturers' brochures and parts lists describing the actual materials used in the work, including metal alloys, finishes, electrical components and other major components. Provide working art file templates to the owner for future use.

1.4 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design and installations of signs, and miscellaneous supports that are similar to those indicated for this Project in material, design, and extent. Engineer must be licensed in the State of Oklahoma.

B. Manufacturer Qualifications: All sign fabrication within this section shall be performed by a manufacturer with a minimum of five (5) years experience producing and installing architectural signs, and a minimum of five (5) years experience producing compliant signs as specified in ANSI 117.1 (1986), Minimum Guidelines and Requirements for Accessible Design (MGRAD), Uniform Federal Accessibility Standards (UFAS) and Americans with Disabilities Act Accessibility Guidelines (ADAAG).
   1. For applied graphic films, perform adhesion tests in accordance with manufacturer's written instructions.

C. Drawings and Specifications: The Architect will provide electronic files of typical sign layout drawings in Adobe Illustrator CC format. For electronic files requested in any format other than Adobe Illustrator CC, the Contractor shall reimburse the Owner, for additional services required of the Architect for converting the electronic files. Architect will provide electronic files indicating fonts, preliminary style guides, and key visual parameters of the design intent.
   1. Drawings and specifications indicate spacings of members, sizes of components, profile, dimensions, materials, and design and fabrication requirements for the signs.
   2. Requests for deviations from indicated dimensions and profiles will be considered provided that the intended aesthetic effect is not modified, as judged and approved solely by Architect. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Uniformity of Manufacturer: For each separate type of sign and graphic image required, obtain signs from a single manufacturer.
   1. Manufacturer's name, trade name, or trade mark shall not appear on any visible surface.

E. Welding Standards: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.2, "Structural Welding Code--Aluminum."
   3. AWS D1.3, "Structural Welding Code--Sheet Steel."
   4. AWS D1.6, "Structural Welding Code--Stainless Steel."

F. Aesthetic Requirements: Provide copy with straight and true edges; space characters as indicated; reproduce type style accurately with square corners and even curves; provide uniform letters and symbols; and provide smooth finishes with no visible imperfections.

G. ADA Accessibility Guidelines: Signage shall comply with the ADA Accessibility Guidelines where applicable. Characters and graphics, including but not limited to, copy height, letter stroke, symbols, materials, and finishes indicated on the Drawings are intended as guidelines for compliance. Implement each applicable ADA Guideline. Should conflicts arise, notify the Architect before proceeding.

H. Mockups: Provide one mockup sign of each type indicated in the schedule at the end of this Section, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and fabrication.
   1. Approved mockups will be forwarded to the Project site and may become part of the completed Work.

I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish sign dimensions and proceed with fabrication without field measurements. Coordinate fabrication with construction progress to avoid delay.

1.6 COORDINATION AND SCHEDULE

A. Installation: Coordinate installation with the Contractor. For signs supported by or anchored to permanent construction, coordinate specific requirements for types and placement of anchorage devices and similar items to be used for attaching signs.
   1. For signs supported by or anchored to permanent construction, furnish templates to the Contractor for installation of blocking, anchorage devices, and electrical conduits.

B. Prepare a schedule indicating engineering, fabrication, delivery, installation, and final inspection of the Work. Submit this schedule to the Architect and Owner for approval and coordination with other work at the Project Site.

C. Coordinate location of remote transformers with building construction. Ensure that transformers are accessible after completion of Work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Package material in like groups and label accordingly.

B. Protect items during transit, delivery, handling, and storage to prevent damage, soiling, and deterioration. Minor damage to finishes may be repaired provided the final finishes are equal to the original finishes and are acceptable to the Architect. If not acceptable, remove and replace damaged items with new signs.

C. Coordinate delivery and storage of sign materials with the Owner. Schedule delivery to minimize storage requirements. Materials stored at the Project Site without prior approval of the Owner, may have to be relocated at the sign contractor’s expense.

1.8 MAINTENANCE

A. Furnish a list of cleaning materials appropriate for maintenance of signs. Provide written instructions for proper maintenance, electrical access, and character and lighting replacement procedures. Include recommended methods for removal of residual adhesives from wall surfaces after removal of adhered signs.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Use materials of size and thickness indicated or, if not indicated as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

B. All materials shall be new stock, free from defects impairing strength, durability, and appearance. No fabrication or installation materials or procedures shall be used that will in any way change the usual quality or in any manner have an adverse effect on existing materials and surfaces.

C. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Signage Detail Manual, in the Graphics and Signage Message Schedule, on Drawings, and on preliminary artwork supplied on electronic media by Architect for size, fonts, style, spacing, content, mounting height and location, materials, finishes, and colors of signage.

2.2 MATERIALS

A. General: For the fabrication of exposed metal work, use only materials which are smooth and free of surface blemishes including pitting, roughness, seam marks roller marks, and trade names. Do not use materials which have stains or discolorations.
   1. Provide stretcher leveled standard of flatness.

B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.
   1. Thickness: Provide aluminum sheets and plates in sizes specified or indicated on the Drawings.

C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.

D. Stainless Steel: Grade and type designated below for each form required:
   1. Tubing: ASTM A 554, Grade MT 316.
   2. Pipe: ASTM A 312/A 312M, Grade TP 316.
   3. Castings: ASTM A 743/A 743M, Grade CF 8M.
   4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316.
   5. Bars and Shapes: ASTM A 276, Type 316.

E. Metal Laminate: Grade 83 (.025" (0.7mm)) solid metals and solid metal strips. Solid aluminum mechanically etched sheet with light epoxy protection.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following for specific applications:
      a. Formica
      b. ChemMetal
      c. NuMetal

d. Wilsonart International.
e. Octolux Solid Matals.

2.3 PLASTIC

A. General: Plastic shall be free of imperfections from forming or fabrication. All surfaces shall be free from scatches and shall be cleaned and polished per manufacturer's instructions at completion of installation. Edges shall be flame polished, free of saw marks and chips, and be eased, unless otherwise noted.

B. Monolithic Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVF (UV filtering), of thickness indicated, with Finish 1 (smooth or polished finish) and Finish 3 (abrasion resistant coating) as indicated.
1. Transparent: Provide colorless sheet with visible light transmittance of 92 percent measured per ASTM D 1003.
   a. Provide Finish 3.
2. Translucent: Provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.
   a. Provide Finish 1.
3. Opaque: Provide colors and finishes indicated or, if not indicated, as selected by Architect from manufacturer's full range.
   a. Provide Finish 1.

C. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

2.4 GRAPHIC FILM

A. General: Provide vinyl graphic film suitable for interior and exterior applications of types indicated below.
1. Vinyl Thickness: 2 mil (0.05 mm), minimum.
2. Adhesive: Clear, pressure sensitive, permanent adhesive.
3. Overlaminate: Include a Matte overlaminate for all interior vinyl graphic films unless otherwise indicated in the Signage Detail Manual.
4. Installation: Use minimum overlapping seams advised by the manufacturer.

B. Basis-of-Design Products: The design is based on the products named. Subject to compliance with requirements, provide either the named products or comparable product by one of the other specified manufacturers. Comparable products are subject to review and approval through the submittal process specified.
1. Opaque Vinyl Film: Nonreflective, pre-spaced die-cut letters and film, supplied in specified typeface, color, and spacing on a quick-release backing sheet.
2. Transparent Vinyl Film: 3M Scotchcal™ Clear Graphic Film 8626 ES.
3. Translucent Vinyl Film: 3M Scotchcal™ Translucent Graphic Film 8628 ES.
4. Opaque Imaging Media for smooth surfaces: 3M Controltac Graphic Film with Comply v3 Adhesive IJ180CV3-10 with 3M Scotchcal Luster Overlaminate 8509
   a. Provide alternate pricing for 3M Scotchcal Graphic Film with Comply Adhesive IJ40C-10R with 3M Scotchcal Luster Overlaminate 8509.
5. 3M Scotch Cal™ for Textured Surfaces; Series IJ8624 with 3M Luster Overlaminate 8524.
6. 3M Panaflex™ Awning and Sign Facing; Series 945GPS.
7. 3M Vinyl 8150 with 7 Year Lifespan for window graphics.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. 3M.
   2. Avery Dennison Graphics Division.
   3. Orocal/Orofol Graphic Products.

2.5 HARDWARE, FASTENERS, AND ADHESIVES

A. Fasteners: Unless otherwise indicated, use concealed fasteners fabricated from metals that are non-corrosive to either the sign material or the mounting surface. If concealed fasteners are not practical or possible, provide vandal-resistant fasteners.

B. Fabricate brackets and fittings for bracket-mounted signs from materials compatible with panel sign construction and mounting conditions indicated. Factory-paint brackets in color matching background color of panel sign.
   1. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, Grade B.
   2. Structural Steel Shapes, Plates, and bars: Cold formed steel fabrications complying with ASTM A36.

C. Anchors and Inserts: Use non-ferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
   1. For attachment to metal panels, use #12 stainless steel, Type 410, self-tapping screws with integral neoprene washers.

D. Adhesives: Provide products equal to "Depend 330” as manufactured by Loctite Acrylic Adhesives. (216)881-2828. Signage manufacturer shall verify with painting manufacturer capatibility of the adhesive to the paint.

E. Very High Bond (VHB) Foam Double Face Tape: Provide vinyl double-sided foam tape of thickness required, and manufactured by 3M, or approved equal.

F. Silicone Adhesive: Provide liquid silicone adhesive (sealant) with a methanol or acetic cure as recommended by the sign fabricator.
   1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Architectural Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.

G. Spacers: Provide Manufacturer's standard spacers when necessary.

2.6 GRAPHIC REQUIREMENTS, GENERAL

A. General: Type style shall be as indicated on the Drawings, or in the Signage Detail Manual.
   1. Typeface and numerals shall be computer digitized by one manufacturer and used for each applicable sign types.
   2. Characters indicated on the Drawings or in the Signage Detail Manual are intended as guidelines for layouts and font size only, and are based on scale calculations of the message lengths within given and estimated sign areas. Drawings and schedules indicate the copy required on individual signs. Should conflicts arise in the final message layout, notify the Architect before proceeding.
   3. Spelling and punctuation shall be correct. Should an error in spelling or punctuation be found, or the spelling appears questionable, notify the Architect before proceeding.
   4. Align letter forms to maintain a baseline parallel to the sign format, unless otherwise indicated. Maintain uniform margins in sign layouts.

5. Office Identification Signs: Owner will determine names of each individual office.
6. Provide digital proofs of final signage layouts to the Architect for approval before fabrication.

B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Raised-Copy Thickness: Not less than 1/32 inch.
2. For Grade 2 Braille copy, coordinate messages in conjunction with Graphic and Sign Schedule. Braille copy contained on drawings is for size and position only and shall not be used for full message.
3. Symbols and other ADA required symbols, (International Symbol of Accessibility; Symbol of Access for Hearing Loss; International TDD Symbol; and Symbol of Volume Control), which are referenced in the documents, are available in EPS formats on 3-1/2 inch Macintosh discs from the Society for Environmental Graphic Design (SEGD), 47 Third Street, Cambridge, MA 02141, telephone 617/577-8225, fax 617/577-1769.

C. Camera-Ready Artwork: Documents include specifications for all visual elements including, but not limited to, type, symbols, logos, photography, artwork, and arrows. Create final "camera-ready artwork" necessary to complete all signs and environmental graphics based on the design intent included in the Drawings.
1. Typeset copy, high resolution photography, original logos and motifs shall be camera-ready artwork used for fabrication.
2. Owner provided logo, photography and motifs at 300 dpi, not human digitization, may be used for initial layouts prepared for shop drawing review. Do not use printed construction documents as base art.
3. Silkscreens shall be executed from photoscreens or negatives. Pattern cut screens may be used where non-repeat copy is required; however, copy mask shall be equivalent to photoscreen quality. Do not use images indicated on the Drawings as camera-ready art.

2.7 FABRICATION, GENERAL

A. General: Fabricate signs to comply with requirements indicated on drawings for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
1. Form exposed faces and sides of signs to produce surfaces free from warp, distortion, and “oil canning.”
   a. Include internal bracing for stability and attachment of mounting accessories as required.
   b. Cut metal edges on a continuous line and sand smooth. Seams shall be straight and symmetrical.
   c. Form exposed connections with hairline joints, flush, and smooth.
   d. Form exposed work true to line and level with sharp angles, surfaces, and edges. Ease exposed edges to a radius of approximately 1/32 inch (0.8 mm) unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or cracking of applied finishes.
2. Welding, when necessary, shall be of the appropriate type to minimize permanent distortions of flat surfaces. Remove welding flux, oxides and discolorations by pickling or grinding, so that these areas match the finish of the adjacent areas. Repair damage caused by the fabrication by grinding, polishing, or buffing.
   a. Weld corners and seams continuously, complying with AWS recommendations. At connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
3. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

4. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus one percent measured diagonally from corner to corner.
5. Fabricate, brackets and fittings for signs to suit sign panel construction and mounting conditions indicated. Connections, angles, shapes and details shown are suggestive and are to be sized, reinforced and detailed as required. Details not shown are to be equal in quality to those detailed. Factory paint brackets in color matching background color of sign panel.
6. Provide concealed access to internally illuminated signs for relamping and service. Service access shall be waterproof and secured against vandalism.
7. Conceal union, fabricator, or other labels.
8. For sign panel units in exterior applications provide standard weatherproofing construction, including weather-stripping, weeping, and venting provisions for condensation control.

B. Metal signs facing and cladding shall be aluminum unless otherwise indicated or specified

C. Where galvanized steel and aluminum meet, the materials shall be materially isolated from one another to prevent electrolytic action. Aluminum joints and connections shall be heli-arc welded and flush, true, ground, and polished smooth and without defects. Character forms shall be cut true to typeface with no burns or imperfections of any kind.

D. Internal Structure: Provide completely hidden, internal structures for support and anchorage, unless indicated otherwise on the drawings. Primary support structure shall hot dipped galvanized steel or aluminum.

2.8 PANEL SIGNS

A. Exterior Plaque Sign: Provide products fabricated from 0.125 inch aluminum plate with 0.030 inch thick double face tape mounting and silicone adhesive. Sign copy shall be raised 1/32 inch from plaque first surface by manufacturer's standard photochemical process. Provide opaque graphics and Braille to comply with ADA regulations.
1. Finish: As indicated on the Drawings or in the Signage Detail Manual.
2. Graphics: As indicated on the Drawings or in the Signage Detail Manual.

B. Interior Plaque Sign: Provide products fabricated from 0.125 inch thick acrylic with exterior grade polyamide resin sign face and 0.011 inch carrier with 0.030 inch double face tape mounting and silicone adhesive. Sign copy shall be raised 1/32 inch from plaque first surface by manufacturer's standard photomechanical stratification process. Provide opaque graphics and Braille to comply with ADA regulations.
1. Finish: Manufacturer's custom color with matte texture.
2. Graphics: As indicated on the Drawings or in the Signage Detail Manual.

C. Chemically-etched Zinc Sign Panels: Sign copy shall be raised 1/32 inch from plaque first surface. Provide opaque graphics and Braille to comply with ADA regulations.
1. Thickness: 0.125 inch.
2. Zinc Finish: Manufacturer’s sandblasted with horizontal grain.
3. Background Texture: Smooth, matte finish.
4. Graphics: As indicated on the Drawings or in the Signage Detail Manual.
5. Manufacturer: Dixie Graphics.

D. Framed Hollow-Box-Type Panels:
1. Panel Material: 0.125-inch-thick aluminum sheet.
2. Panel Finish: Baked enamel.
    a. Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.
    b. Provide clips welded to back of panels for installation without visible fasteners.

3. Frame Material: Extruded aluminum, fabricated to profile indicated; comply with the following:
   a. Frame Finish: High-performance organic coating.
   b. Corner Condition: Corners rounded to radius indicated.
4. Illuminated-Sign Units: Provide internal illumination using concealed, internally wired, LED system to illuminate message panels uniformly with minimum halation and without light leaks. Include LED's, transformers, and other components necessary for complete systems. Make provisions for servicing and concealing transformers and connections to building electrical system. Coordinate electrical characteristics with those of power supply provided. Loading shall be verified by following the testing procedures recommended by the LED-systems manufacturer.
   a. Color: Refer to Drawings and Signage Detail Manual for color temperature.
   b. Population: Maximum 4-inch spacing between LED strips or segments.
      1) Basis of Design : GE Tetra LED light strips

2.9 FABRICATED LETTERS AND NUMBERS

A. Channel Characters: Fabricate letters and numbers to the required sizes and styles, using metals and thicknesses indicated below. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories as required. Fabricate by the heliarc welding process.
   1. Aluminum Sheet: Not less than 0.090 inch thick.
   2. Finish: Manufacturer's custom color urethane.
      a. Color: As indicated on the Drawings or in the Signage Detail Manual.

B. Reverse Channel Characters: Fabricate letters and numbers to the required sizes and styles, using metals and thicknesses indicated below. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories as required. Fabricate by the heliarc welding process.
   1. Aluminum Sheet: Not less than 0.090 inch thick.
   2. Finish: Manufacturer's custom color urethane.
      a. Color: As indicated on the Drawings or in the Signage Detail Manual.

C. Illuminated LED Channel Characters: Provide LED illuminated channel character systems for exterior applications as indicated on the drawings. Include LED's, transformers, and other components necessary for complete systems. Make provisions for servicing and concealing transformers and connections to building electrical system. Coordinate electrical characteristics with those of power supply provided. Loading shall be verified by following the testing procedures recommended by the LED-systems manufacturer.
   1. Color: As indicated on the Drawings or in the Signage Detail Manual.
   2. Population: Maximum 4-inch spacing between LED strips or segments.
   3. All LEDs to use constant current technology.
   4. All LEDs to be IP67 rated for interior environments, and IP68 in exterior or open air environments.
   5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work may include:
      a. Bitro Group.
      b. Sloan LED.
      c. GE Lighting.
      d. Osram.

2.10 PRINTED BANNERS

A. General:
1. Unless otherwise specified in the Signage Detail Manual or on the Drawings, provide banner material suitable for exterior applications of type indicated below:
   a. 22 mil white-pigmented vinyl substrate with a polyester scrim.
   b. 3M Panagraphics III Wide With Flexible Substrate
2. Flame Resistance for Interior Banners: Passing NFPA 701, Part 2.
3. Overlaminate for Exterior Banners: 3M Scotchcal™ Matte Overlaminate 8520.
4. Banner Weights: Concealed.
5. Seams: None.
6. Wind slits: None.
7. Printed Image: 3M Scotchprint electrostatic.

B. Light Pole Attachment Brackets: Unless otherwise specified in the Signage Detail Manual or on the Drawings, Spring-loaded, wind release brackets designed for winds up to 90 mph.
1. Basis of Design: “BannerSaver Brackets” by Britten Banners & Event Solutions.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

D. Preparation: Substrates shall be smooth, clean and free of dust, grease, finger prints, or other foreign matter. If necessary to obtain true color application, surface shall be “primed” with white before final color application is applied. Artwork shall be accurately reproduced with all edges straight and true and all finishes smooth and with no visible imperfections
1. Surface preparation: Follow paint manufacturer’s instructions for preparing surfaces before applying primers or graphics.

E. Corrosion Protection: Coat concealed surfaces which will be in contact with concrete, stone, masonry, wood, or dissimilar metals, in exterior work and work to be built into exterior and below grade walls and decks, with a heavy coat of bituminous paint. Do not extend coating onto exposed surfaces.

F. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide custom color matches as selected by the Architect.
1. Aluminum: Acrylic polyurethane paint as specified in this Section.

2.12 ALUMINUM FINISHES

A. Aluminum: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
1. Class I, Clear Anodic Finish: AA-M12C22A41; Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.7 mil (18 µm or thicker) complying with AAMA 611.

2. Class I, Color Anodic Finish: AA-M12C22A42/A44; Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrodeposited color coating 0.7 mil (18 µm or thicker) complying with AAMA 611.
   a. Color: As selected by Architect from the full range of industry colors and color densities.

B. Baked-Enamel Finish: Manufacturer's standard baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
1. Color: Match Architect's sample.

2.13 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Unless otherwise indicated, grind and polish surfaces to produce uniform finish indicated, free of cross scratches.
1. Run grain of directionally textured finishes with long dimension of each piece, unless otherwise indicated in the Signage Detail Manual or on the Drawings.

C. Stainless Steel Finishes:
1. Directional Satin Finish: No. 4.
2. Dull Satin Finish : No. 6.
3. Reflective, Directional Polish : No. 7.
4. Mirrorlike Reflective, Non Directional Polish : No. 8.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.14 PAINT MATERIALS

A. Primer: High build, two part polyamide epoxy.

B. Opaque Finish Coat: Two-part, satin finish acrylic polyurethane paint. Provide products equal to Matthews Paint Company's "Low VOC Satin MAP - Acrylic Polyurethane," custom colors with gloss between 11 and 19 units @ 60 degrees.

C. Powder Coating: Polyester based powder coating type finish for sheet steel.

D. Silkscreen: Use fast drying opaque enamel silkscreen ink.
1. Colors and Sheen: High gloss color not limited to manufacturer's standard colors.

E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Examine area, surfaces and conditions under which the work is to be installed. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Starting work implies acceptable surfaces and conditions.

3.2 INSTALLATION

A. General: Locate sign units and accessories where shown on Sign Schedule, Signage Detail Manual and sign reference plans, attaching signs to substrates in accordance with manufacturer's instructions, unless otherwise indicated.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
   2. Interior Wall Signs: Unless otherwise specified in the Signage Detail Manual or on the Drawings, install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Surfaces under adhesive applied units shall be smooth, clean, and free of dust, grease, fingerprints, or other foreign matter. All adhesives required shall be used in accordance with recommendations made by the manufacturer of the material to be laminated or adhered. No adhesives that will fade, discolor, or delaminate as a result of ultraviolet light or heat shall be used. Adhesives shall not change the color of or deteriorate the materials to which they are to be applied. The adhesives shall be of a non-staining, non-yellowing quality. All visible joints shall be free from air bubbles and other defects.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
   2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
   3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
   4. Z clips and Brackets: Remove loose debris from substrate surface and install Z clip or bracket supports in position so that signage is correctly located and aligned.
   5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
   6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

E. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
1. Flush-Mounting: Mount panel signs with backs in contact with wall surface.
2. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
3. Hook-and-Loop Tapes: Use hook-and-loop tapes to mount signs to smooth, nonporous surfaces.
4. Magnetic Tape: Use magnetic tape to mount signs to smooth, nonporous surfaces.
5. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
6. Shim Plate Mounting: Provide 1/8-inch-thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
7. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
8. Where panel signs are scheduled or indicated to be mounted on glass, provide opaque vinyl film on opposite side of glass to conceal mounting materials. Color of vinyl to be 3M Scotchcal 7725 “Pearl Grey” unless otherwise noted in the Signage Detail Manual or on the Drawings..

F. Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
1. Pin Mounting: A minimum of three threaded studs (1/8 inch diameter by 1/2 inch long minimum) welded to back or bottom of character with no distortions or discolorations to sign face. Appropriately increase size of studs according to weight of characters.
2. Flush Mounting: Mount characters with backs in contact with wall surface.
3. Projected Mounting: Mount characters at projection distance from wall surface indicated.

G. Bracket-Mounted or Suspended Units: Use custom fabricated brackets, fittings and hardware as appropriate for mounting signs which project at right angles from supporting elements or suspended from structural members. Attach brackets and fittings with concealed fasteners and anchoring devices, unless otherwise indicated, to comply with the manufacturer's directions.

H. Illuminated Characters:
1. Run wires into wall construction through conduit. Use insulators as necessary for neon lighting wiring.
2. Exposed-to-view wiring or conduit on wall face is not permitted.
3. Engage a licensed electrician to connect wiring to power source.

3.3 FIELD QUALITY CONTROL

A. Within one week of scheduled completion of installation, prepare a punch list itemizing the following:
1. Uppercase letters instead of lowercase or vice-versa.
2. Improper alignment of letters on sign panel.
3. Improper alignment of signs.
4. Chipped or scratched finishes.
5. Unpainted exposed fasteners.
6. Fabricator’s label displayed.
7. Improper cleaning of sign surfaces or surrounding wall areas.
8. Damage to surrounding surfaces.
9. Missing signs, graphics, displays.

10. Incorrect install locations.
11. Missing trim, corner guards, or other finishing.
12. Any areas that require touch up paint.

B. Repair or replace damaged units as required after Architect's final inspection.

3.4 PATCH AND ADJUST

A. Patch existing surfaces damaged as a result of work under this section. Patch with same materials as existing. Sign Contractor shall paint and harmoniously blend and contour all repairs to match adjoining conditions.

B. Touch-up any mars or nicks in painted finishes of all signs and adjacent structures. Touch-up shall be the same paint product as used for this sign finish.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780, Annex A2.

3.5 CLEANING AND PROTECTION

A. At completion of installation, clean exposed sign surfaces in accordance with the manufacturer's instructions. Signs shall be free of glue, fingerprints, dirt, grease, or any other imperfections.

B. Evidence of installation work or damages incurred on other surfaces shall be cleaned or repaired prior to completion of work. Protect units from damage until acceptance by Owner.

C. Remove all packing and construction materials from site. Leave premises clean, ready for work under other contracts or ready for use.

D. Instruct the Owner in writing as to the correct operation and maintenance of all signs and sign components.

E. Demonstrate to the Owner the operation of all access panels, and replacement of lamps, ballasts, and transformers as applicable.

F. Furnish Owner with a pint of each paint and finish material used on sign.

3.6 WARRANTY

A. Submit to the Owner's Representative a 1-year written warranty (effective the date of final acceptance) covering all signs contractor will agree to repair or replace defective signs. Upon notification of such defective signs within the warranty period, make necessary repairs or replacement at the convenience of the Owner's Representative.

B. Submit to the Owner's Representative a 1 year written warranty, warranting that the factory-applied finishes will not develop excessive fading or excessive non-uniformity of color or shade, and will not crack, peel, pit, corrode or otherwise fail because of defects in materials or workmanship within the following defined limits. Upon notification of such defects within the warranty period, make necessary repairs or replacement at the convenience of the owner's representative.

END OF SECTION

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast dimensional characters.
2. Fabricated channel dimensional characters.
3. Illuminated, fabricated channel dimensional characters.

1.2 DEFINITIONS

A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.3 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.
1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
1. Dimensional Characters: Full-size Sample of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

F. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.
1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design sign structure and anchorage of rooftop dimensional character sign type(s) to withstand design loads as indicated on Drawings. Engineer shall be licensed in the State of Oklahoma.

B. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Translucent face with metal side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability and for securing fasteners; and as follows.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. A.R.K. Ramos.
      b. ACE Sign Systems, Inc.
      c. Allen Industries Architectural Signage.
      d. APCO Graphics, Inc.
      e. ASI Sign Systems, Inc.
      f. Diskey Architectural Signage Inc.
      g. Gemini Incorporated.
      h. Metallic Arts.
      i. Nelson-Harkins Industries.

j. Poblocki Sign Company, LLC.
k. Steel Art Company.

2. Illuminated Characters: Frontlighted character construction with LED lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
   a. Power: As indicated on Electrical Drawings.
   b. Weeps: Provide weep holes to drain water at lowest part of exterior characters. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.
3. Character Material: Sheet or plate aluminum.
4. Material Thickness: Manufacturer's standard for size and design of character.
5. Translucent Face Sheet: Acrylic sheet, 0.5 inches thick, and with integral color as selected by Architect from manufacturer's full range.
6. Character Height: As indicated.
7. Character Depth: As indicated.
8. Finishes:
   a. Integral Aluminum Finish: Clear anodized.
9. Mounting: Projecting studs, stainless steel.
   a. Hold characters at distance as selected by Architect from wall surface.
10. Typeface: As selected by Architect.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

E. Zinc Castings: ASTM B 240, alloy and temper recommended by sign manufacturer for type of use and finish indicated.

F. Zinc Sheet: ASTM B 69, alloy and temper recommended by sign manufacturer for type of use and finish indicated.

G. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
   a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant slots unless otherwise indicated.

4. Sign Mounting Fasteners:
   a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
   b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
   c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

B. Adhesives: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color color unless otherwise indicated.
2. Stainless-Steel Brackets: Factory finish brackets to match sign background finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Directional Satin Finish: No. 4.
3. Dull Satin Finish: No. 6.
4. Reflective, Directional Polish: No. 7.
5. Mirrorlike Reflective, Nondirectional Polish: No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that electrical service is correctly sized and located to accommodate signs.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
   2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
   3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
   4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
   5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
   6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" and Section 09 22 16 “Non-Structural Metal Framing” for blocking in metal stud walls.
   2. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.
   1. Include plans, elevations, sections, details, and attachment details.
   2. Show locations of cutouts for compartment-mounted toilet accessories.
   3. Show locations of centerlines of toilet fixtures.
   4. Show locations of floor drains.
   5. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.
   1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated.
   1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
   2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Regulatory Requirements: Comply with applicable provisions in The Department of Justice's 2010 ADA Standards, and IBC and ICC/ANSI A117.1 or other locally enforced accessibility standards, for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Accurate Partitions Corporation.
   2. General Partitions Mfg. Corp.
   3. Scranton Products.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
   1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
   2. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):
   1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel or aluminum.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
   1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts.
   2. Mounting: surface mount
   3. Latch and Keeper: Manufacturer's heavy-duty surface-mounted stainless-steel slide latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
      a. Keeper: 2-1/2 inch stainless steel with rubber insert.
   4. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
   5. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.

6. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221.

C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

D. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
1. Confirm location and adequacy of blocking and supports required for installation.

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

C. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet compartment anchorage.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
   a. Pilasters and Panels: 1/2 inch.
   b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
   a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corner guards.
   2. End-wall guards.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for steel angle corner guards.
   2. Section 08 71 00 "Door Hardware" for protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.
   1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
   1. Corner Guards: 12 inches long. Include example top caps.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Corner-Guard Covers: Full-size of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- long units.
   2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period materials are stored.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
      b. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 50 or less.
   2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 CORNER GUARDS (CG1)

A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
   1. Manufacturers: Subject to compliance with requirements, provide Korogard Wall Protection Systems, Anodized Aluminum Corner Guard; or comparable products by one of the following:
      a. American Floor Products Company, Inc.
      b. Babcock-Davis.
      c. Balco, Inc.
      d. Boston Retail Products.
      e. Construction Specialties, Inc.
      f. Hiawatha, Inc; a division of the Activar Construction Products Group.
      g. InPro Corporation (IPC).
      h. JL Industries, Inc.; a division of the Activar Construction Products Group.
      i. Nystrom, Inc.
      j. Pawling Corporation.
      k. Tepromark International, Inc.
   2. Material: Extruded anodized aluminum, 1.6mm thick, with dark bronze aluminum finish.
   3. Wing Size: Nominal 1/2 (127mm) by 1/2 (127mm) inches.
   4. Corner Radius: 1/8 inch.
   5. Mounting: Adhesive.

2.4 MATERIALS

A. Adhesive: As recommended by protection-product manufacturer and with a VOC content of 70 g/L or less.

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Quality: Provide surfaces free of wrinkles, dents, uneven coloration, and other imperfections.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with dents, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Washroom, shower, and custodial accessories.
2. Baby changing stations.
3. Underlavatory guards.

B. Related Sections:
1. See Division 10, Toilet Compartments, for hooks on toilet partitions unless hooks are noted otherwise within this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain accessories from single source from single manufacturer.
   1. When Basis of Design product is listed below, provide comparable quality and aesthetically consistent product from the available manufacturers listed below.

B. Washrooms, Showers, and Custodial Accessories Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. AJW Architectural Products.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. Brey-Krause Manufacturing Co.
   6. GAMCO Specialty Accessories; a division of Bobrick.
   7. InPro Corporation
   8. Seachrome Corporation.
   9. Tubular Specialties Manufacturing, Inc.
   10. Sloan Valve Company

C. Baby Changing Station Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. American Specialties, Inc.
   2. Diaper Deck & Company, Inc.
   3. Foundations Children's Products.
   4. GAMCO Specialty Accessories; a division of Bobrick.
   5. Koala Kare Products.
   6. SafeStrap Company, Inc. (SSC, Inc.).
   7. Tubular Specialties Manufacturing, Inc.

2.2 WASHROOM, SHOWERS, AND CUSTODIAL ACCESSORIES

A. Not all numbers are used.

B. Paper Towel Dispensers and Waste Receptacles

TA03 Surface Mounted Paper Towel (Roll) Dispenser - Automatic:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-2974.
2. Description: Electronic sensor automatically dispenses towel when hands are placed under the towel opening. Battery operated.
3. Mounting: Surface mounted.
4. Minimum Capacity: 8-inch-wide, 800-foot-long roll.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
6. Lockset: Tumbler type.

TA06 Recessed Combination Towel (Roll) Dispenser/Waste Receptacle:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-3961 ClassicSeries.
2. Description: Combination unit for dispensing preset length of roll paper towels, with removable waste receptacle.
3. Mounting: Recessed with projecting receptacle.
   a. Designed for nominal 4-inch wall depth.
4. Minimum Towel-Dispenser Capacity: 8-inch- wide, 800-foot-ong roll.
5. Minimum Waste-Receptacle Capacity: 12 gal.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

C. Toilet Tissue Dispensers

TA20 Multi-Roll Toilet Tissue Dispenser:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-2888 ClassicSeries.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with heavy duty, theft-resistant spindle.
5. Capacity: Designed for up to 5-1/4-inch-diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Lockset: Tumbler type.

D. Seat Cover Dispensers; Napkin/Tampon Vendors and Disposal Units; and Tissue Dispensers

TA27 Recessed Toilet Seat-Cover Dispenser:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-301 ClassicSeries.
2. Mounting: Recessed.
3. Minimum Capacity: 500 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

TA31 Surface Mounted Sanitary-Napkin Disposal Unit:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-254 ClassicSeries.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Grab Bars and Cane Detection Bars

TA40 Grab Bars:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6806 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

TA41 Grab Bar, Shower:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6806 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length:
   a. Horizontal: 2-wall right angle for shower stall; 19-3/4 by 34-3/4 inches overall. (B-6861)

TA42 Cane Detection Bars:
1. Basis-of-Design Product: ASI 3275.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration: Wall to floor at drinking fountains projecting into the accessible route.

F. Soap Dispensers and Dishes

TA50 Automatic Wall Mounted Liquid-Soap Dispenser:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-2013.
2. Description: Sensor-activated for dispensing foam soap.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 27 oz.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
6. Lockset: Hinged lid with special key.
7. Refill Indicator: Acrylic window type, hinged for refilling and maintenance.
8. Operation: Sensor-activated valve, no contact with dispenser required to function.

TA54 Surface Mounted Soap Dish
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6807.
2. Description: Horizontal soap dish with flange and support arm, and concealed wall plate.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, No. 4 finish (satin)

G. Baby Changing Stations

TA60 Surface Mounted Baby-Changing Station, Horizontal:
1. Basis-of-Design Product: American Specialties, Inc.; 9013-9 Roval.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support a minimum of 400-lb static load when opened.
3. Mounting: Surface Mounted.
4. Operation: Counterbalanced with a damped gas spring.
5. Material and Finish: Stainless steel, No. 4 finish (satin), exterior shell with rounded corners, high-impact-resistant plastic interior changing smooth finish surface in manufacturer’s standard light gray color.
6. Liner Dispenser: Built in.
7. Paper Towel Dispenser: Built in.
8. Bag Hook: 2.

H. Mirrors

TA70, TA71 Glass Mirror with Stainless Steel Angle Frame:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-290 Series.
2. Frame: Stainless-steel angle, 0.05 inch thick, beveled inside edge.
   a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. Manufacturer's screw locking design wall bracket.
4. Size:
   a. TA70: 18 by 36 inches, or as indicated on the Drawings.
   b. TA71: 24 by 72 inches.

I. Shelves

TA72 Not used.

TA73 Stainless Steel Shelf:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-295 x 16.
2. Description: With exposed edges turned down not less than 3/4 inch and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches long by 5 inches deep.
4. Material and Finish: Not less than nominal 0.05-inch-thick stainless steel, No. 4 finish (satin).

TA74 Stainless Steel Shelf:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-298 x 18.
2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
3. Size: 18 inches long by 8 inches deep.
4. Material and Finish: Not less than nominal 0.05-inch-thick stainless steel, No. 4 finish (satin).

J. Hooks, Mop Holder, Laundry Pass Through, and Shower Accessories

TA80 Towel Pin:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6777.
2. Description: Projecting minimum of 3 inches from wall surface.
3. Mounting: Unit secured to concealed wall plate with setscrews.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

TA81 Utility Hook:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-211.
2. Description: Single-prong unit.
3. Mounting: Unit secured to concealed wall plate with setscrews.
4. Material and Finish: Satin nickel-plated brass.

TA82 Mop and Broom Holder:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-223 x 36
2. Length: 36 inches.
3. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

TA84 Folding Shower Seat:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-517 (Right-Hand) and B-518 (Left-Hand).
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: White vinyl padded seat.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
5. Dimensions: 32-7/8 by 22-11/16 inches overall.

TA85 Shower Curtain Rod:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6047 ClassicSeries.
2. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch-thick stainless steel.
3. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
4. Finish: No. 4 (satin).
5. Length: As indicated on Drawings

TA86 Shower Curtain and Hooks:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-204 Series.
2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Vinyl, minimum 0.008 inch thick, opaque, matte, with integral antibacterial and flame retardant agents.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

2.3 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
1. Plumberex Specialty Products, Inc. “Handy-Shield Maxx.”

2. Trubro, “Soft Guard Plus.”

B. Insulating pipe covering for supply and drain piping required to prevent direct contact with piping and to allow service access without removing coverings at all lavatories.

C. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

E. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

G. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
1. Provide galvanized steel backing sheet, not less than 0.034 inch (0.85 mm) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

C. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Coordinate cutouts in reinforced CMU walls to avoid structural grouted cells. Relocate unit as necessary. Verify required relocation with Architect.

C. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

D. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

3.3 SCHEDULE

Item No.	Product Description	Quantity Criteria
TA03	Surface Mounted Paper Towel (Roll) Dispenser - Automatic	1 per restroom or as indicated.
TA06	Recessed Combination Towel (Roll) Dispenser/Waste Receptacle	1 per restroom or as indicated.
TA20	Multi-Roll Toilet Tissue Dispenser	1 per water closet
TA27	Recessed Toilet Seat-Cover Dispenser	1 per water closet
TA31	Surface Mounted Sanitary-Napkin Disposal Unit	1 per Women’s water closet & individual Women’s toilet
TA40	Grab Bars	1 set per accessible & ambulatory accessible toilet stalls 1 set per accessible urinal
TA41	Grab Bar, Shower	1 per accessible shower stall
TA42	Cane Detection Bars	1 set per drinking fountain (single or pair, when not in alcove)
TA50	Automatic Wall Mounted Liquid-Soap Dispenser	1 per lavatory
TA54	Surface Mounted Soap Dish	1 per individual shower head
TA60	Surface Mounted Baby-Changing Station, Horizontal	1 per restroom
TA70	Glass Mirror 18 X 36	Quantity as indicated
TA71	Glass Mirror 24 X 72	Quantity as indicated
TA73	Stainless Steel Shelf	1 per Infant Changing Table 1 per Accessible Lavatory 1 per Family Toilet
TA74	Stainless Steel Shelf	1 per Janitor’s Closet
TA80	Towel Pin	1 per shower stall
TA81	Utility Hook	3 per Janitor’s Closet
TA82	Mop and Broom Holder	1 per Janitor’s Closet

Item No.	Product Description	Quantity Criteria
TA84	Folding Shower Seat	1 per accessible shower stall
TA85	Extra Heavy Duty Shower Curtain Rod	1 per shower stall
TA86	Shower Curtain and Hooks	1 per shower stall

END OF SECTION

SECTION 10 43 13 - DEFIBRILLATOR CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes defibrillator cabinets.

B. Related Requirements:
1. Section 10 43 14 "Automated External Defibrillators" for AEDs.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to defibrillator cabinets including, but not limited to, the following:
a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For defibrillator cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For defibrillator cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final defibrillator cabinet schedule with defibrillator schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For defibrillator cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of defibrillator cabinets to ensure that type and capacity of automated external defibrillators indicated are accommodated.

B. Coordinate sizes and locations of defibrillator cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DEFIBRILLATOR CABINET

A. Cabinet Type: Suitable for automated external defibrillators.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. JL Industries, Inc.; a division of the Activar Construction Products Group.

b. Modern Metal Products, Division of Technico Inc.

B. Cabinet Construction: Nonrated and fire rated for fire-resistance rating of walls where they are installed.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
1. Square-Edge Trim: 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Acrylic sheet.
1. Acrylic Sheet Color: Clear transparent acrylic sheet.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:
1. Identification: Lettering and graphic complying with authorities having jurisdiction.
a. Identify defibrillator cabinet with words and graphic applied to cabinet glazing.
2. Alarm Contacts: Manufacturer's standard contact device for connecting to building security system that actuates when defibrillator cabinet door is opened.

K. Materials:
1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
a. Finish: Baked enamel or powder coat.
b. Color: Manufacturer’s standard white.
2. Stainless Steel: ASTM A 666, Type 304.
a. Finish: No. 4 directional satin finish.
3. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 6 mm thick, with Finish 1 (smooth or polished).

2.3 FABRICATION

A. Defibrillator Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of defibrillator cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish defibrillator cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed defibrillator cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install defibrillator cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Defibrillator Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of defibrillator cabinets, square and plumb.

C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust defibrillator cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of defibrillator cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace defibrillator cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by defibrillator cabinet and mounting bracket manufacturers.

E. Replace defibrillator cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 10 43 14 - AUTOMATED EXTERNAL DEFIBRILLATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes automated external defibrillators (AEDs).

B. Related Requirements:
   1. Section 10 43 13 "Defibrillator Cabinets" for cabinets housing AEDs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of AEDs that fail in materials or workmanship within specified warranty period.
   1. Device: 10 years from date of Substantial Completion.
   2. Accessories: 1 year from date of Substantial Completion.
   3. Batteries: 4 years from date of Substantial Completion.
   4. Defibrillator pads: Expiration date indicated on pads package.

PART 2 - PRODUCTS

2.1 AUTOMATED EXTERNAL DEFIBRILLATORS

A. Automated External Defibrillators (AEDs): Designed for use by layperson first responders with no training, on patients of any age.
   1. Products: Subject to compliance with requirements, available products include, but are not limited to, the following:
      a. Phillips Medical Systems; HeartSmart OnSite Defibrillator.
      b. Physio Control; Lifepak.
      c. Zoll; AED Plus.
   2. Weight: 3.3 lbs.
   3. Guided audio instructions for device use and CPR coaching.
   4. Senses application of pads to patient, and changes voice instructions.
   5. Patient Analysis: Evaluates patient ECG to determine if a rhythm is shockable.
   6. Shock Time: 8 seconds after CPR interval; less than 20 seconds shock-to-shock.
   7. Preinstalled pads cartridge; spare pads cartridge in case.
   8. Retrievable summary of care from internal memory: First 15 minutes of ECG and the entire incident’s events and analysis decisions.
   9. Self-Tests: Automatic, daily.
      a. Internal circuitry.
      b. Waveform delivery system.
      c. Pads cartridge.
      d. Battery capacity.
   10. Battery: 9 Volt DC, non-rechargeable lithium.
   11. Meets AAMI DF80 guidelines and AHA recommendations for adult defibrillation.

PART 3 - EXECUTION

3.1 DEMONSTRATION

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

END OF SECTION

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.
      b. Fire hose valves.
      c. Fire hoses and racks.

B. Related Requirements:
   1. Section 10 44 16 "Fire Extinguishers."
   2. Division 21 for fire-hose connections.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
      a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing mounting method and relationships of box and trim to surrounding construction.
   1. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire-protection cabinets. Indicate mounting method. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Basis of Design Product: Subject to compliance with requirements, provide Potter Roemer Fire Pro a Morris Group International; Model #7050 for extinguisher only cabinets and Model #1870-SS-10-A for combination fire hose connections and extinguisher cabinets; or comparable products by one of the following:
      a. Guardian Fire Equipment, Inc.; Series 1800.
      b. JL Industries, Inc.; a division of the Activar Construction Products Group; Panorama Series.
      c. Larsens Manufacturing Company; Architectural Series.
   2. Slim profile Extinguisher Cabinet: For use with slim profile fire extinguishers. Cabinet must fit into 3 5/8” stud wall. Constructed of powder coated, cold rolled steel with acrylic glazed door.
      a. JL Activar, FX2 Fire Rated Extinguisher Cabinet.
      b. Oval Fire Products, Inc.; flush recessed cabinet.

B. Cabinet Construction: Rated and nonrated cabinets matching fire-resistance rating of walls where they are installed.
   1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Stainless Steel - #304 Stainless Steel with #4 finish.

D. Recessed Cabinet:
   1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Stainless-steel sheet.

H. Door Style: Fully glazed panel with frame.

I. Door Glazing: Tempered float glass (clear).

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide projecting door pull and friction latch or projecting lever handle with cam-action latch as standard with manufacturer.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:
   1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet glazing.
         2) Application Process: Pressure-sensitive vinyl letters.
         3) Lettering Color: White.

4) Orientation: Vertical.

2. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by low voltage, complete with transformer.

L. Materials:
1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
a. Finish: Baked enamel or powder coat.
a. Color: As selected by Architect from full range of industry colors and color densities.
b. Finish: Clear anodic.
2. Stainless Steel: ASTM A 666, Type 304.
a. Finish: No. 4 directional satin finish.
3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
   4. Fire-Rated Hose and Valve Cabinets:
      a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
      b. Seal through penetrations with firestopping sealant as specified in Section 07 84 13 "Penetration Firestopping."

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:
1. Section 10 44 13 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

C. Wet-Chemical Type: UL-rated 2-A:K, 2.5-gal. nominal capacity, with potassium acetate-, potassium citrate-, or potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.

2.3 SLIM PROFILE PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Definition:
1. Fire extinguisher that when wall mounted on a bracket projects less than 4 inches from the face of wall. Complies with protruding object guidelines from ADA and ANSI A117.1.
2. Recessed wall cabinet and extinguisher that projects less than 1 inch from the face of wall and overall depth is less than 4” deep to fit in gypsum board wall assembly using 3-5/8” studs. Complies with protruding object guidelines from ADA and ANSI A117.1.

B. Location: As indicated on Drawings.

C. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

D. Multipurpose Dry-Chemical Type: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container. See Drawings for mounting types.
1. Surface Mounted:
a. Oval Brand Model 10HABC.
b. JL Orbit, Model FE10V or FE10VB.
2. Cabinet Mounted:
a. Oval Brand Model 10JABC.
b. JL Orbit, Model FE10V.

2.4 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Provide five (5) additional fire extinguishers beyond the units shown on Drawings, to be installed at locations determined by Architect during construction.

END OF SECTION

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SECTION 10 73 18 – PREFABRICATED METAL CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pre-engineered, all-extruded aluminum overhead canopies.
      a. System shall be all welded extruded aluminum system. Non-welded systems are not acceptable.
      b. Design canopies in accordance with The Aluminum Design Manual 2000.

B. Related Requirements:
   1. Section 05 12 00 “Structural Steel Framing.”
   2. Section 05 50 00 "Metal Fabrications."
   3. Section 06 10 53 “Miscellaneous Rough Carpentry.”
   4. Section 07 62 00 "Sheet Metal Flashing and Trim" for items made of formed metal for flashings and trim.

1.2 COORDINATION

A. Coordinate installation of anchorages for prefabricated canopies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

B. Coordinate installation of canopies with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for canopies.

B. Shop Drawings:
   1. Include plans, elevations, sections, mounting heights, and attachment details.
   2. Detail fabrication and assembly of canopies.
   3. Show locations for blocking, reinforcement, and supplementary structural support.
   4. Show details of flashing at wall condition, and drainage away from canopy.

C. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator and professional engineer.

B. Welding certificates.

C. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Build mockups for the following types of overhead canopies:
      a. Prefabricated extruded aluminum canopies.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal canopy products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with prefabricated metal canopies by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including framework.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design prefabricated metal canopies, including attachment to building construction. Engineer must be licensed in the State of Oklahoma.

B. Structural Performance: Prefabricated canopy items, including anchors and connections, shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:
   1. Wind Loads on Exterior Items: As indicated on Structural Drawings, and in compliance with ASCE 7.

C. Seismic Performance: Exterior prefabricated canopy items, including anchors and connections, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Component Importance Factor: 1.0.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Architectural Fabrication, Inc.
   2. Dittmer Architectural Aluminum.
   3. Mapes Industries, Inc.
   4. Peachtree Protective Covers, Inc.

B. Basis-Of-Design Products: Subject to compliance with requirements, provide the following:
   1. Mapes Industries, Inc., Super Lumideck, no hanger rods.
   2. Mapes Industries, Inc., Super Lumideck, with hangar rods.
   3. Mapes Industries, Inc., Super Lumideck, post-supported.
   4. Locations and types of prefabricated canopies, including profiles, fascia depth and overall sizes, are indicated on Architectural Drawings.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by canopy manufacturer for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
   1. Aluminum Plate and Sheet: ASTM B 209.
   2. Aluminum Extrusions: Alloy 6063-T6, ASTM B 221.

B. Decking And Fascia: Extruded aluminum, alloy 6063-T6, in profile and thickness per manufacturer’s details.
   1. Decking: 2 3/4” deep, extruded 0.078” thick decking, square corrugated profile as indicated.
   2. Fascia: Standard 8” extruded “J” style (minimum .125 aluminum), unless otherwise indicated on Architectural Drawings.

C. Hanger Rods: Zinc-plated steel, thickness per manufacturer’s details.
   1. Powder coated to match canopy.

D. Flashing: Shall be ASTM B 209, Type 3003 H14, minimum 0.040-inch aluminum, fabricated to prevent leakage and sealed with metal roof sealant in clear or color match.

E. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for canopy assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

F. Structural Anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 .

G. Isolation Coating: Manufacturer's standard alkali-resistant coating.

H. Gaskets: Dry seal santoprene pressure type.

I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. Shop Assembly: Preassemble metal canopy items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of metal canopy items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

C. All connections shall be mechanically assembled utilizing 3/16” fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

D. Decking shall be designed with interlocking extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.
   1. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.
   2. Provide welded plate closures at deck ends.

E. Fascia: Manufacturer’s standard shapes. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.

F. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce canopy items as needed to attach and support other construction.

G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
   1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

H. Concealed drainage. Water shall drain from covered surfaces into integral fascia gutter and directed to either the front for front drainage or to the rear for ground level discharge via one or more designated downspouts.

2.5 GENERAL FINISH REQUIREMENTS

A. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

B. Powder coat finish per ASTM D 3451, complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking and minimum dry film thickness. Color to be selected from manufacturer's standard colors.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, and other conditions affecting performance of the Work.
   1. Installer shall confirm dimensions and elevations to be as shown on shop drawings.

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

3.2 INSTALLATION, GENERAL

A. Fabricate and preassemble canopies in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

C. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 INSTALLATION OF PREFABRICATED CANOPIES

A. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing canopies to structural support and for properly transferring load to in-place construction.
   1. Nonwelded Connections: Use mechanical joints for permanently connecting components. Use wood blocks and padding to prevent damage to members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of canopies.

B. Perform cutting, drilling, and fitting required to install metal canopies. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of metal canopies, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

F. Field Brazing: Comply with requirements for brazing and for finishing brazed connections in "Fabrication, General" Article. Braze connections that are not to be left as exposed joints but cannot be shop brazed because of shipping size limitations.

G. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
   1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

H. Coordinate canopy installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed exterior wall assemblies.
   1. Install concealed gaskets, joint fillers and flashings as work progresses.

3.4 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Protect finishes of metal canopies from damage during construction period with temporary protective coverings approved by metal canopy manufacturer. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 10 75 16 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles.
   1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
   2. Include section, and details of foundation system.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design flagpole assemblies. Engineer must be licensed in the State of Oklahoma.

B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
   1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is indicated on Structural Drawings.

2. Base flagpole design on polyester, nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone -tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Acme/Lingo Flagpoles LLC.
      b. American Flagpole; a Kearney-National Inc. company.
      c. Baartol Company.
      d. Concord Industries, Inc.
      e. Eder Flag Manufacturing Company, Inc.
      f. Ewing Flagpoles.
      g. Morgan-Francis Flagpoles and Accessories.
      h. Pole-Tech Company Inc.
      i. U.S. Flag & Flagpole Supply, LP.

B. Exposed Height: 60 feet or as indicated on Drawings.

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Cast-Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor-bolt mounting; furnish with anchor bolts.
   1. Furnish ground spike.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
   1. 0.063-inch spun aluminum with gold anodic finish.

B. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch-diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
   1. Halyards and Cleats: One at each flagpole.
   2. Cleat Covers: Cast metal, finished to match flagpole, secured with cylinder locks.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

PART 3 - EXECUTION

3.1 PREPARATION

A. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

B. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

C. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION

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SECTION 10 81 13 - BIRD CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:
   1. Bird spikes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For bird spikes.

C. Sample Warranty: For manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For bird control devices to include in maintenance manuals.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of bird control devices that fail in materials, including UV resistance, or workmanship within specified warranty period.
   1. Warranty Period: 10 year(s) from date of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of construction to receive bird control devices by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 BIRD NETTING

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Bird Barrier; StealthNet.
   2. Nixalite of America Inc.; K-Net HT Bird Netting.
   3. Bird-B-Gone, Inc.; Bird Net 2000.

2.2 BIRD SPIKES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Nixalite of America Inc.; Premium Model S Nixalite Bird Spike, or comparable product by another manufacturer.

B. Bird Spike Strips:
   1. Material: Stainless steel, Type 316.
   2. Flexible Spikes:
      a. Height: 4 inches
      b. Density: Not less than 120 wires per foot.
   3. Overall Width: 4 inches.

2.3 ACCESSORIES

A. Mounting Accessories: Provide manufacturer's stainless steel mounting accessories for complete installation, including, but not limited to, fasteners, brackets, and clips.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with manufacturer's requirements for installation, tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Remove bird droppings and clean area protected by bird control devices prior to installation.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations.

B. Where bird spike strips are indicated, use multiple strips to cover entire surface (not just edges. Cut strips for tight fit, following angles and contours.

END OF SECTION

SECTION 11 12 00 - PARKING CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vehicle detectors.
2. Traffic controllers.
3. Miscellaneous parking control equipment.
4. Parking facility management software.
5. Access control units.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for pipe bollards to protect parking control equipment.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Verify that equipment operation is consistent with system description.
3. Review sequence of operation for each type of parking control equipment.
4. Review coordination of interlocked equipment specified in this Section and elsewhere.
5. Review required testing, inspecting, and certifying procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for parking control equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties.

B. Shop Drawings: For parking control equipment.
1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Vehicle Detectors: Layout and method of placement of vehicle loop detector system.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For parking control equipment to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.

4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain parking control equipment from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Parking Control System: Parking management and control, including but not limited to, guest parking, duration-of-event parking, special-event parking, and employee access, shall be determined by Owner.

B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 VEHICLE DETECTORS

A. General: Provide detection devices that sense presence or transit of vehicles and emit signals activating gate-arm operators.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Amano McGann.
      b. Amtel Security System Inc.
      c. Delta Scientific Corp.
      d. Engineered Parking Systems, Inc.
      e. Federal APD, Inc.
      f. Magnetic Autocontrol Group.
      g. Operator Specialty Co., Inc.; Linear LLC group member.
      h. Parking Systems, Inc.
      i. PTC Industries.

B. Vehicle Loop Detector System: Self-tuning electronic presence detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, designed to hold gate arm open until traffic clears. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location indicated on Drawings, as recommended in writing by detection system manufacturer for pave-over installation.
   1. Field-Assembled Loop: Wire, in size indicated for field assembly.
   2. Operation:
      a. Recognize vehicles within 6 inches of each other on standard-sized loop.
      b. Recognize vehicle direction by detecting vehicle moving from one loop to another.
      c. Generate reverse count if vehicle backs up after generating directional count in forward direction.
      d. Continuous diagnostic monitoring for intermittently operating and failed loops.
      e. Crosstalk test between adjacent loops.

C. Active Infrared Vehicle Detector: Retroreflective or Emitter/receiver-type presence detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of vehicle in gate-arm pathway by interrupting infrared beam in zone pattern and to emit signal activating gate-arm operator. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, and vehicle presence detector designed to hold gate arm open until traffic clears.

2.4 MISCELLANEOUS PARKING CONTROL EQUIPMENT

A. "Lot Full" Signs : Single-faced signs consisting of illumination source contained in welded steel bodies with extended hood and baked-enamel finish. Sign copy shall be 4 inches tall.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Amano McGann.
      b. Amtel Security System Inc.
      c. Automatic Systems; a subsidiary of The IER Group.
      d. Canadian Parking Equipment Ltd./American Parking Equipment Inc.
      e. Cubic Transportation Systems, Inc.
      f. Delta Scientific Corp.
      g. DoorKing, Inc.
      h. Engineered Parking Systems, Inc.
      i. Federal APD, Inc.
      j. LiftMaster; The Chamberlain Group, Inc.
      k. Magnetic Autocontrol Group.
      l. Operator Specialty Co., Inc.; Linear LLC group member.
      m. Parking Booth Company, Inc.
      n. Parking Products Inc.
      o. Parking Systems, Inc.
      p. PTC Industries.
      q. WPS Parking Systems.
      r. Zeag USA Inc.
   2. Type: Flashing.
   3. Operation: Manual by push button.
   4. Illumination: Traffic signal lamps and colored fiberglass sign face.
   5. Mounting: 42-inch-high pedestal.

2.5 PARKING FACILITY MANAGEMENT SOFTWARE

A. General: Manufacturer's standard software that is compatible with security-access control system and that provides automatic facility monitoring, supervision, and remote control of parking control equipment from one or more locations.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Amano McGann.
      b. Amtel Security System Inc.
      c. Automatic Systems; a subsidiary of The IER Group.
      d. Canadian Parking Equipment Ltd./American Parking Equipment Inc.
      e. Cubic Transportation Systems, Inc.
      f. Federal APD, Inc.
      g. Magnetic Autocontrol Group.
      h. Parking Products Inc.
      i. Parking Systems, Inc.
      j. WPS Parking Systems.
      k. Zeag USA Inc.

B. Operation:
1. Collect data for revenue and activity reporting.
2. Collect data for access and space control.
3. Track tickets.
4. Programmable parking control equipment.

2.6 ACCESS CONTROL UNITS

A. General: Provide access control unit that activates barrier gates.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Amano McGann.
b. Amtel Security System Inc.
c. Canadian Parking Equipment Ltd./American Parking Equipment Inc.
d. Cubic Transportation Systems, Inc.
e. DoorKing, Inc.
f. Engineered Parking Systems, Inc.
g. Federal APD, Inc.
h. LiftMaster; The Chamberlain Group, Inc.
i. Magnetic Autocontrol Group.
j. Operator Specialty Co., Inc.; Linear LLC group member.
k. Parking Products Inc.
l. Parking Systems, Inc.
m. PTC Industries.
n. WPS Parking Systems.
o. Zeag USA Inc.

B. Unit Housing: Fabricate from welded cold-rolled steel or aluminum sheet with weatherproof front access panel equipped with flush-mounted lock and two keys. Provide face-lighted unit fully visible at night.
1. Steel Finish: Manufacturer's standard baked-enamel or powder-coat finish system.

C. Card Reader Controlled Unit: Functions only when authorized card is presented.
1. System: Programmable, multiple-code capability permitting validation or voiding of individual cards.
a. Permit four different access time periods.
2. Reader: Swipe type for magnetic-stripe, barcode, and Wiegand cards.
3. Reader: Insertion type for magnetic-stripe, barcode, and Wiegand cards.
4. Reader: Proximity type for proximity cards.
5. Operation: Online communication to remote parking control system computer and security access system.
6. Characteristics: Timed antipassback, Limited-time usage, or capable of monitoring and auditing barrier gate activity as directed by Owner.
7. Mounting: In enclosed cabinet.
8. Cards: Provide 200 minimum.

D. Digital Keypad Controlled Unit: Functions only when authorized code is entered on keyless-membrane keypad.
1. System: Programmable, multiple-code capability permitting validation or voiding of no fewer than 2500 possible individual codes, consisting of one to six digits, and permitting four different access time periods.
2. Operation: Online communication to remote parking control system computer and security access system.
3. Characteristics: Timed antipassback, Limited-time usage, or capable of monitoring and auditing barrier gate activity as directed by Owner.
4. Mounting: With pedestal.

2.7 ANCHORAGES

A. Anchor bolts; hot-dip galvanized according to ASTM A 153/A 153M and ASTM F 2329.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before parking control equipment installation.

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

3.2 INSTALLATION

A. General: Install parking control equipment as required for complete and integrated installation.
   1. Rough-in electrical connections.

B. Vehicle Loop Detectors: Cut grooves in pavement and bury and seal wire loop at locations indicated on Drawings according to manufacturer's written instructions. Connect to parking control equipment operated by detector.

C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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

C. Perform the following 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. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Parking control equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust parking control equipment to function smoothly, and lubricate as recommended by manufacturer.

B. Confirm that locks engage accurately and securely without forcing or binding.

C. After completing installation of exposed, factory-finished parking control equipment, inspect exposed finishes and repair damaged finishes.

3.5 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain parking control equipment.

END OF SECTION

SECTION 11 24 29 - FACILITY FALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes anchor-type and horizontal lifeline-type fall restraint systems for Owner's employee fall prevention in areas indicated on Drawings, including but not limited to the following:
   1. Roof access areas.
   2. Ladder access in lieu of ladder safety cages.

B. Owner-Furnished Components: Components of fall restraint systems furnished by Owner include, but are not limited to, the following:
   1. Lanyards.
   2. Connectors.
   3. Body Belts.
   4. Body Harnesses.

C. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for ladders.
   2. Section 07 72 00 "Roof Accessories" for ladder-assist posts attached to roof access ladders.

1.2 DEFINITIONS

A. Fall Restraint System: Fall protection system that prevents the user from falling any distance. The system is comprised of either a body belt or body harness, along with an anchorage, connectors and other necessary equipment. The other components typically include a lanyard, and may also include a lifeline and other devices.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles.
   2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Product Schedule: For fall restraint systems.

D. Delegated-Design Submittal: For each fall restraint system.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, testing agency, and professional engineer.

B. Welding certificates.

C. Product Certificates: For each fall restraint system component complying with referenced standards.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fall restraint systems to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of engineering, fabricating, and installing fall restraint systems that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: Manufacturer, or an authorized representative who is trained and approved by manufacturer.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components, including related accessories, from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Evan Corporation, Inc.
2. Fallsafe.net.
3. Flexible Lifeline Systems.
4. Probel, http://www.pro-bel.ca/
5. Spider; A Division of SafeWorks, LLC.
6. Thern, www.thern.com
7. Tritech Fall Protection Systems.
8. Unistrut Fall Protection.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design fall restraint systems. Engineer shall be licensed in the State of Oklahoma.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

C. Capacities and Characteristics: Design systems according to project design loads indicated on the Drawings, and complying with requirements of the ANSI/ASSE Z359 “Fall Protection Code,” OSHA, and authorities having jurisdiction.

2.3 COMPONENTS

A. General: Provide components necessary for complete fall restraint systems that meet or exceed performance requirements.

2.4 ACCESSORIES

A. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant, compatible, nonstaining materials. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install fall restraint systems to comply with performance requirements and requirements indicated on Shop Drawings.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections required by authorities having jurisdiction, and required of the referenced standards for facility fall protection.

B. Fall restraint system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 DEMONSTRATION

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

END OF SECTION

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SECTION 11 31 00 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigeration appliances:, Free standing,.
   2. Cleaning appliances: Dishwasher.

B. Related Requirements:
   1. Division 12 for countertops.
   2. Division 22 for plumbing fixtures.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Field quality-control reports.

D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design.

2.3 REFRIGERATOR/FREEZERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amana; a division of Whirlpool Corporation.
   2. BSH Home Appliances Corporation (Bosch).
   3. Dacor, Inc.
   4. Electrolux Home Products (Frigidaire).
   5. Fisher & Paykel Appliances Limited.
   6. General Electric Company (GE Appliances).
   7. General Electric Company (Hotpoint).
   8. Jenn-Air; a division of Whirlpool Corporation.
   9. KitchenAid; a division of Whirlpool Corporation.
   10. LG Electronics.
   11. Maytag; a division of Whirlpool Corporation.
   12. Miele, Inc.
   13. Samsung.
   14. Sears Brands LLC (Kenmore).
   15. Sub-Zero, Inc. (Sub-Zero and Wolf).
   16. Whirlpool Corporation.

B. Refrigerator/Freezer: Configuration as determined by Owner and complying with AHAM HRF-1.
   1. Type: Freestanding.
   2. Dimensions:
      a. Width: As indicated on Drawings.
      b. Depth: As indicated on Drawings.
      c. Height: As indicated on Drawings.
   3. Storage Capacity:
      a. Refrigeration Compartment Volume: As determined by Owner.
      b. Freezer Volume: As determined by Owner.
   4. General Features:
      a. Dispenser in door for ice and cold water with dispenser lock.
      b. Built-in water-filtration system.
      c. Dual refrigeration systems.
      d. Separate touch-pad temperature controls for each compartment.
   5. Refrigerator Features:
      a. Interior light in refrigeration compartment.
      b. Temperature-controlled meat/deli bin.
   6. Freezer Features: One freezer compartment.
      a. Automatic defrost.
      b. Interior light in freezer compartment.

c. Automatic icemaker and storage bin.
7. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
8. Front Panel(s): Stainless steel.
9. Appliance Color/Finish: Stainless steel.

2.4 DISHWASHERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amana; a division of Whirlpool Corporation.
2. ASKO North America.
3. BSH Home Appliances Corporation (Bosch).
4. Dacor, Inc.
5. Electrolux Home Products (Frigidaire).
6. Fisher & Paykel Appliances Limited.
7. General Electric Company (GE Appliances).
8. General Electric Company (Hotpoint).
9. Jenn-Air; a division of Whirlpool Corporation.
10. KitchenAid; a division of Whirlpool Corporation.
11. LG Electronics.
12. Maytag; a division of Whirlpool Corporation.
13. Miele, Inc.
14. Samsung.
15. Sears Brands LLC (Kenmore).
16. Whirlpool Corporation.

B. Dishwasher: Complying with AHAM DW-1.
1. Basis-of-Design Product: GE Dishwasher; GDF650SSJSS.
2. Type: Built-in undercounter.
3. Dimensions:
a. Width: 24 inches.
b. Depth: 23 inches.
c. Height: 34-1/2 inches.
4. Sound Level: Maximum 48 dB.
5. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.
6. Rack System: PVC-coated sliding dish racks, with removable cutlery basket.
7. Controls: Touch-pad controls with four wash cycles and hot-air and heat-off drying cycle options.
8. Features:
a. Waste food disposer.
b. Self-cleaning food-filter system.
c. Hot-water booster heater for 140 deg F wash water with incoming water at 100 deg F.
9. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
10. Front Panel: Stainless steel.
11. Appliance Color/Finish: Stainless steel.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

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

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

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

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections :
   1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
   2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After installation, start units to confirm proper operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

SECTION 11 40 00

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. The work referred to in this section consists of furnishing all labor and material required to provide and deliver all equipment hereinafter specified into the building, uncrate, assemble, hang, set in place, level, and completely install, exclusive of final utility connections.

B. Coordinate but do not install (unless specifically directed to do so in the technical specifications) Owner and Vendor-supplied equipment noted on the drawings or in the specifications as NIKEC. Show on roughing in plans the sizes, utilities, and other requirements as furnished in the Specifications, by Owner or appropriate supplier in submittals as if the equipment is contractor furnished.

C. Coordinate and show sizes, utilities, and other requirements as determined by physical inspection for equipment noted as existing to be reused. Include costs for marking, removing, storing, cleaning, redelivering and installing such equipment. All requirements within the project manual apply to reused equipment except warranty as if contractor furnished including but not limited to code compliance and accessories necessary to conform with the new application.

D. Should there be any discrepancies or inconsistencies that occur between the foodservice drawings and specifications, request written clarification; provide the better quality, and the greater quantity of work or material without any additional costs to the owner. The kitchen equipment contractor is responsible for any costs incurred by failure to clarify any conflicting requirements.

E. Secure and pay fees for permits, test, and inspections required by all authorities having jurisdiction and directly related to the construction and installation of the 11 40 00 foodservice equipment work.

1.2 RELATED SECTIONS / WORK IN THE MECHANICAL AND ELECTRICAL DIVISIONS:

A. Refer to the mechanical/plumbing divisions regarding mechanical services including, but not limited to, all water, gas, and steam rough-ins, pressure regulating valves, check valves, shut-off valves, grease traps, steam traps, drain traps, vents, valves, floor sinks, faucets, drains, floor drains, duct work, pipes and pipe fittings, and all other materials required to complete final connections to the foodservice equipment. Additional work not included in the 114000 scope; G.C. to coordinate and provide:
   1. Hood and ventilator duct work and fans upstream from the connection positions
   2. Installation of floor troughs, including set-in place and final connections.

B. Refer to the electrical divisions regarding electrical services including, but not limited to, all electrical rough-ins, standard and low voltage wiring, drop cords, disconnects, breakers, shunt trip breakers, and all other materials required to complete final connections to the foodservice equipment. Additional work not included in the 114000 scope; G.C. to coordinate and provide:
   1. Installation of the light fixtures furnished loose for the walk-in coolers/freezers
   2. Wiring of the exhaust hood controls including, but not limited to, all low voltage interconnections.
   3. Connection of hood fire suppression system building alarm system

4. Connection of walk-in cooler/free-zer temperature alarm system to the building alarm system.

C. Additional work not included in the 11 40 00 Section Additional work not included in the 114000 scope; G.C. to coordinate and provide:
1. Slab depressions for walk-in coolers/freezers, floor troughs, and other applicable foodservice equipment.
2. Wall backing to support wall mounted foodservice equipment
3. Concrete pads for outdoor equipment such as refrigeration racks, compressors, etc.
4. Roof rails, roof curbs, pitch pockets, coring, flashing, and fire stopping required for roof top foodservice equipment and related refrigeration piping.

1.3 SUBMITTALS

A. Upon award of Contract, furnish the Architect with reproducible copies of the following drawings, in accordance with the approved project schedule, which shall be made on sheets equal in size and matching the bid set drawing size. Reproduced copies of bid documents will not be accepted for this purpose in any fashion.
1. Equipment specified for fabrication shall be detailed and fully dimensioned to a minimum scale of 3/4" = 1'-0" (1:20) for plan and elevation views and 1-1/2" = 1'-0" (1:10) for sections.
2. Prepare separate electrical and mechanical dimensioned rough-in drawings at 1/4" = 1'-0" (1:50) showing exact point of penetration of floors, walls, and ceilings for all services required to operate the equipment that the Contractor shall furnish, including the requirements for Contractor supplied and installed refrigerant and beverage piping line runs. These drawings shall also show exact locations of final connections to equipment. Indicate floor drains, floor sinks, receptacles, lights, and other special conditions related to the equipment known to the Contractor but provided under other Sections.
3. Dimensioned drawings shall be submitted showing the location and size of all bases, depressions, grease interceptors, special height walls, openings in walls for equipment or operations, and critical dimensions, etc. Drawings shall be drawn to a scale of not less than 1/4" = 1'-0" (1:50).

B. Manufacturers' Data: Upon award of Contract, submit bound copies of Manufacturers' Illustrations and Technical Data to the Architect for review prior to procurement. Items of Standard Manufacture shall be submitted, including items purchased to be built into fabricated equipment. Each illustration shall be marked to describe accurately the item to be furnished as specified, including voltage, phase, load, accessories, etc.

C. Manufacturers' List: Submit in writing a list of all manufacturers' representatives of the foodservice equipment, such as convection ovens, ranges, etc., and their authorized service agencies' addresses and telephone numbers.

D. Foundation Data: Data and drawings shall be submitted for each item, if any, requiring special foundations, structures, or supports. Such foundations, structures, or supports will be provided and installed by other appropriate trades in accordance with the drawings and specifications which shall be provided by the Contractor and reviewed by the Architect.

E. Operation and Maintenance Manuals: Provide three bound copies of operation, maintenance, and parts manuals for all equipment items of standard manufacture including standard component assemblies built into all custom-fabricated items.

F. Review by the Architect of the drawings and brochures submitted by the Contractor does not waive the responsibility of the Contractor to furnish each item of equipment in complete compliance with the specifications and contract drawings.

G. The number of copies of all submittals shall be as determined by the Architect.

H. Samples: Samples of materials, products, and fabrication methods shall be submitted for review at no additional cost, before proceeding with the work.

1.4 QUALITY ASSURANCE

A. Standard Products: Materials, products, and equipment furnished under this contract shall be the standard items of manufacturers regularly engaged in the production of such materials, products, and equipment and shall be of the manufacturers' latest design that complies with the specifications.

B. Manufacturers' Qualifications: Manufacturers shall be regularly engaged in the production of the items furnished and shall have demonstrated the capability to furnish similar equipment that performs the functions specified or indicated herein.

C. Installation Qualifications: Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work defined in this Section.

D. Coordination of Work: Coordinate work with the respective trades performing preparatory work for installation of equipment under this Contract, including, but not limited to: construction of pits, trenches, receptors; rough-in of supply, waste and vent piping; electrical connections; and field verification of dimensions.

E. Product Options: Drawings indicate foodservice equipment based upon equipment specified herein. All substitutions shall be in compliance with the requirements in Division 1 (or Section I if appropriate.).

F. Conflict: Where written specifications and drawings conflict or appear to conflict, request clarification. Prior to receiving clarification use the greater quality or greater quantity.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver foodservice equipment in containers designed to protect equipment and finish until final installation. Make arrangements to receive equipment at project site at a time and place agreed with the General Contractor. If the site is not ready for delivery, then either delay delivery or arrange to hold in a secure and protected warehouse until delivery can be made to job site.

B. Store foodservice equipment in original containers and in location to provide adequate protection to equipment while not interfering with other construction operations. Coordinate with other trades so that worktables, serving counters and equipment are not used for scaffolding or as workbenches.

C. Handle foodservice equipment carefully to avoid damage to components, enclosures, and finish. Do not install damaged foodservice equipment; replace and return damaged components to equipment manufacturer.

1.6 APPLICABLE CODES AND STANDARDS

A. Except as otherwise indicated, each item of equipment shall comply with the latest current edition of the following standards as applicable to the manufacture, fabrication, and installation of the work in this section. Comply with all Federal, State, and Municipal regulations and notifications which bear on the execution of this work. Call to the attention of the Owner in writing any design conflict with the requirements of the Americans with Disabilities Act (ADA) during Bid Process so resolution can be effected prior to Contract Award.

1. NSF Standards: Comply with applicable National Sanitation Foundation standards and criteria and provide NSF "Seal of Approval" on each manufactured item and on major items of custom-fabricated work.

2. UL / ETL / CSA Standards: For electrical components and assemblies, provide either UL / ETL / CSA listed products or, where no listing service is available, provide a complete index of the components used as selected from the UL / ETL / CSA "Recognized Component Index." For fire extinguishing systems comply with UL 300.
3. ANSI Standards: Comply with applicable ANSI standards for electric-powered and gas-burning equipment; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.
4. AGA / CGA: All gas-fired equipment shall be AGA / CGA approved, equipped to operate on the type gas available at the job site, and shall contain 100% automatic safety shut-off devices.
5. NFPA Standards: Comply with NFPA Bulletin 96 for exhaust systems; with NFPA Bulletins 13, 17, 17A and 96 for fire extinguishing systems; and with NFPA 54, National Fuel Gas Code and NFPA 70, National Electrical Code.
6. ASME Code: Comply with ASME boiler code requirements for steam-generating and steam-heated equipment; provide ASME inspection, stamps, and certification of registration with National Board.
7. SMACNA Guidelines: Provide seismic restraints for food service equipment to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines", appendix 1, "Guidelines for Seismic Restraints of Kitchen Equipment", unless otherwise indicated.
8. ASHRAE: Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration".

1.7 PROJECT CONDITIONS

A. Visit the job site to field check actual wall dimensions and roughing-in and be responsible for furnishing, fabricating, and installing the equipment in accordance with the available space and utility services as they exist on the job site for an accurate fit.

B. Check all door openings, passageways, elevators, etc., to be sure that the equipment can be conveyed to its proper location within the building and, if necessary, check with the Contractor regarding the possibility of holding wall erection, placement of doorjambs, windows, etc., for the purpose of moving the equipment to its proper location. Any removal and rebuilding of walls, partitions, doorjambs, etc., necessary to place the equipment or, if caused by incorrect information on the Contractor's drawings, shall be done at the expense of the Contractor.

C. Physically check the location and utility size of all "rough-ins" at the job site for compatibility with the equipment being installed before finished floors, walls, and/or ceilings are in place.

D. Check electrical characteristics and water, steam, and gas pressure. Provide pressure-regulating valves where required for proper operation of equipment.

1.8 GUARANTIES AND WARRANTIES

A. Self-contained or remote refrigeration systems furnished under this Contract shall be provided with start-up and a one-year service contract providing free service, 24 hours per day, seven days per week, including parts and labor. Hermetic or semi-hermetic compressors shall be covered by the manufacturers' factory warranty for an additional four years. Other equipment provided shall include a one-year warranty covering parts and labor, plus any extended warranties as normally provided by individual manufacturers. Equipment including refrigeration systems both self-contained and remote shall be warrantied by the Contractor on the project for one year as indicated in the preceding sentence. The first day of the first year commences upon the issuance of a certificate of occupancy for each area.

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment and its component parts shall be new and unused. All items of standard manufactured equipment shall be current models at the time of delivery. Parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement, and repair.

B. Means shall be provided to ensure adequate lubrication for moving parts. Oil holes, grease fittings, and filler caps shall be accessible without the use of tools.

C. The design of the equipment shall be such as to provide for safe and convenient operation. Covers or other safety devices shall be provided for all items of equipment presenting safety hazards. Such guards or safety devices shall not present substantial interference to the operation of the equipment. Guards shall provide easy access to guarded parts.

D. Trim shall not be an acceptable substitute for accuracy and neatness. When trim is required and accepted by Architect in lieu of rejection of items of equipment, it shall be the Contractor's responsibility to provide same at no additional cost.

E. Unless otherwise specified herein, no material lighter than #20 gauge shall be incorporated into the work. Gauges for sheet iron and sheet steel shall be U.S. Standard Gauges and finished equipment gauge thickness shall not vary more than 5% plus or minus from the thickness indicated below.

GAUGE	THICKNESS	GAUGE	THICKNESS
#10	0.1406” (3.0mm)	#16	0.0625” (1.6mm)
#12	0.1094” (2.5mm)	#18	0.0500” (1.25mm)
#14	0.0781” (2.0mm)	#20	0.0375” (1.0mm)

F. Materials or work described in words which have a well-known and accepted technical or trade meaning shall be held to refer to such accepted meanings.

2.2 MATERIALS

A. Submit a certified copy of the mill analysis of materials if requested by the Architect.

B. Stainless steel sheets shall conform to American Society for Testing and Materials (ASTM) specification A240, Type 304 Condition A, 18-8, having a No. 4 finish. A No. 2B finish shall be acceptable on surfaces of equipment not exposed to view. Sheets shall be uniform throughout in color, finish, and appearance.

C. Stainless steel tubing and pipe shall be Type 304, 18-8, having a No. 4 finish, and shall conform to either ASTM A213 if seamless or ASTM A249 if welded.

D. Rolled shapes shall be of the cold-rolled type conforming to ASTM A36.

E. Galvanized sheet steel shall conform to ASTM A526; where extensive forming to take place, conform to ASTM A527; conform to ASTM A525, coating designation G115, chemical treatment.

F. Galvanized steel sheets shall be cold-rolled, stretcher leveled, bonderized, and rerolled to ensure a smooth surface.

G. Castings shall be corrosion-resisting metal containing not less than 30% nickel. Castings shall be rough ground, polished, and buffed to bright luster and free from pit marks, runs, checks, burrs, and other imperfections. In lieu of corrosion- resisting metal castings, die-stamped or cast 18-8 stainless steel will be acceptable.

H. Millwork materials shall be free from defects impairing strength, durability, or appearance; straight and free from warpage; and of the best grade for their particular function. Wood shall be well

seasoned and kiln dried and shall have an average moisture content of 8%, a maximum of 10%, and a minimum of 5%.

1. Plywood and other woodwork of treatable species, where so required by the code, shall be fire-retardant treated to result in a flame spread rating of 25 or less with no evidence of significant progressive combustion when tested for 30 minutes duration under ASTM E84 and shall bear the testing laboratory mark on a surface to be concealed.
2. Concealed softwood or hardwood lumber shall be of poplar, Douglas fir, basswood, red oak, birch, maple, beech, or other stable wood and shall be select or better grade, unselected for color and grain, surfaced four sides, square-edged, and straight. Basswood may be used where fire-retardant treated materials are required.
3. Plywood for transparent finish shall conform to U.S. Product Standard PS-51-71, Type I (fully waterproofed bond), with architectural grade face veneers of species as specified, free of all pin knots, patches, color streaks and spots, sapwood, and other defects. Plywood designated to have plywood cores shall be of either 5 ply or 7 ply construction. Plywood so designated on the drawings and plywood not otherwise shown shall have a particle board core, cross banding of veneers, and face and back veneers. Particle board cores shall have a 45-pound density, except where the fire-retardant treatment requires cores of lesser density.
4. Face veneers shall be matched for color and grain to produce balance and continuity of character. Mineral streaks and other discolorations, worm holes, ruptured grain, loose texture, doze, or shake will not be permitted. Face veneer leaves on each surface shall be full-length, book matched, center matched, and sequence matched. Surfaces shall be sequenced and blueprint matched. Veneers not otherwise indicated shall be plain sliced. Backing veneers for concealed surfaces shall be of a species and thickness to balance the pull of the face veneers.
5. Hardwood plywood for painted surfaces shall conform to U.S. Product Standard PS-51-71, Type I, and shall have sound birch, maple, or other approved close grain hardwood faces suitable for a paint finish.
6. Perforated hardboard shall be a tempered hardboard, 1/4" (6 mm) thick, conforming to Federal Specification LLL-B-810B, Type I, SIS, Finish B (primed), Design B (perforated), with ¼" (6 mm) diameter holes spaced on 1" (25 mm) centers both ways.
7. Plastic laminate surfaces shall be laminated with thermosetting decorative sheets of the color, pattern, and style as selected by the Architect. Horizontal surfaces shall be laminated with sheets conforming to Federal Specification L-P-508F, Style D, Type I (general-purpose), Grade HP, Class 1, 1/16" (2 mm) thick, satin finish, with rough sanded backs. Vertical surfaces shall be laminated with sheets conforming to Federal Specification L-P-598F, Style D, Type II, (vertical surface), Grade HP, Class 1, non-forming, satin finish, 1/32" (1 mm) thick or heavier. Surfacing for curved surfaces shall be laminated from sheets conforming to Federal Specification L-P-508F, Style D, Type III (post-forming), Grade HP, Class 1, satin finish. Balance sheets for backs in concealed locations shall be either reject material of the same type and thickness as the general-purpose grade facing or may be .020" (0.5 mm) thick laminate backing sheets conforming to Federal Specification L-P-00508E, Style ND, Type V (backing sheet), Grade HP.
8. Adhesive for application of plastic laminate to wood substrates of counter tops shall be a phenolic, resorcinol, or melamine adhesive conforming to Federal Specification MMM-A-181C and producing a waterproof bond. Adhesive for applying plastic laminate to vertical surfaces shall be either a waterproof type or a water-resistant type such as a modified urea- formaldehyde resin liquid glue conforming to Federal Specification MMM-A-188C. Contact adhesive will not be acceptable.
9. Plywood for laminate assemblies shown or specified with plywood core shall be of the 5 or 7 ply construction with sanded close-grain hardwood face and back veneers, laminated with waterproof glue, in thickness shown, conforming to U.S. Product Standard PS-51-71. Particle board for plastic laminate assemblies shown or specified with particle board wood core shall conform to U.S. Products Standard CS-236-66, Type 1 or 2, Grade

B (45-pound density), Class 2; except where fire-retardant treatment is required, the density shall conform to the treatment requirements.

I. Sealant: ASTM C 920; type S, Grade NS, Class 25, use, NT. Provide elastomeric sealant, NSF certified for end use application indicated. Provide sealant that, when cured and washed, meeting requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food. Dow-Corning #780 or General Electric "Silastic" or approved equal in either clear or approved color to match surrounding surfaces and applied in accordance with sealant manufacturers' recommendations for smooth, sealed finish.

J. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class 1 (clear), Quality q3 (glazing select). Provide products complying with ANSI Z97.1, manufactured by horizontal (roller hearth) process and ¼" (6 mm) thick, unless otherwise indicated. Provide exposed safety edges, if any, seamed before tempering.

K. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8" (3 mm) thickness that does not chop, flake, or blister.

2.3 FINISHES

A. Paint and coatings shall be of an NSF approved type suitable for use in conjunction with foodservice equipment. Such paint or coating shall be durable, non-toxic, non-dusting, non-flaking, and mildew resistant; shall comply with all governing regulations; and shall be applied in accordance with the recommendations of the manufacturer.

B. Exterior, galvanized parts, exposed members of framework, and wrought steel pipe where specified to be painted shall be cleaned, properly primed with rust-inhibiting primer, degreased, and finished with two (2) coats of epoxy-based grey hammertone paint, unless otherwise specified.

C. Stainless steel, where exposed, shall be polished to a #4 commercial finish. Where unexposed, finish shall be #2B. The grain of polishing shall run in the same direction wherever possible. Where surfaces are disturbed by the fabricating process, such surfaces shall be finished to match adjacent undisturbed surfaces.

D. Galvanized shelving shall not be painted.

E. Fabricated equipment shall be spray coated with plastic suitable for protecting the equipment during transport and installation. The coating shall be easily removable and shall be removed after the equipment installation is complete at the work site or, alternatively, when directed by the Architect.

F. Exposed surfaces on brass, bronze, or steel shall be plated with chromium over nickel in accordance with Federal Specifications WW-P-541, Paragraph 9.5 and Table 9.4, unless otherwise specified.

2.4 ELECTRICAL AND MECHANICAL REQUIREMENTS

A. Standard UL / ETL / CSA listed materials, devices, and components shall be selected and installed in accordance with NEMA Standards and recommendations and as required for safe and efficient use and operation of the foodservice equipment without objectionable noise, vibration, and sanitation problems.

1. Provide recognized commercial grade signals, "on-off" pushbuttons or switches, and other speed and temperature controls as required for operation of each item, complete with pilot lights and permanent engraved, plastic laminate signs and graphics identifying each item. Provide stainless steel cover plates at controls and signals.

2. Each item requiring electrical power shall be equipped with either a terminal box for permanent connection or with cord and plug for interruptible connection, as indicated. Provide NEMA standard grounding type plugs, where used.
3. Furnish foodservice equipment completely wired internally using wire and conduit suitable for a wet location, including a separate grounding wire. Provide electrical outlets and receptacles required to be mounted on or in fabricated equipment and interconnect to a suitable terminal box (subpanel, starter, or disconnect switch if so specified) with all wires neatly tagged showing item number, voltage characteristics, and load information.
4. Receptacles for all wall- and floor-mounted outlets will be provided to be used for plug-in equipment with characteristics as noted on the drawings. Provide Hubbell three-wire or four-wire grounding-type connectors and neoprene cords installed on each item of plug-in equipment to match receptacles provided.
5. Electrically heated equipment shall be internally wired to a thermostatic control and an "on-off" red neon light indicator, which shall be mounted in a terminal box on a removable stainless steel access panel.
6. Only rigid steel zinc-coated conduit shall be used, painted to match adjacent surfaces where exposed. Wiring shall be run concealed wherever possible.
7. Provide on, or for, each motor-driven appliance or electrical heating or control unit, a suitable control switch or starter of the proper type and rating.
8. Appliances shall be furnished complete with motors, driving mechanism, starters, and controllers, including but not limited to, master switches, timers, cut-outs, reversing mechanism, and other electrical equipment if and as applicable. Wiring and connection diagrams shall be furnished with electrically operated machines and for electrically wired fabricated equipment.
9. Appliances shall be of rigid construction, free from objectionable vibration. Quietness of operation of all foodservice equipment is a requirement. Remove or repair any equipment producing objectionable noise and/or vibration as directed by the Architect.
10. Motors shall be of the drip-proof, splash-proof, or totally enclosed type, having a continuous duty cycle and ball bearings, except small timing motors which may have sleeve bearings. Motors shall have windings impregnated to resist moisture. Motors located where subject to deposits of dust, lint, or other similar matter from the machine on which installed shall be of the totally enclosed type. Motors shall have ample power to operate the machines for which designated under full load operating conditions without exceeding their nameplate ratings. Horsepower requirements on driven equipment shall be determined by the manufacturer based on normal operation at maximum capacity. The nominal rated motor horsepower shall be not less than the horsepower required for normal operation of the equipment at maximum capacity. Insulation shall be NEMA Class B, or better.
11. Cover plates shall be furnished and installed for all electrical outlets, receptacles, switches, etc., to match the material and finish of the equipment to which they will be -fastened.
12. Switches, controls, etc., shall be conspicuously labeled as to use with plastic nameplates secured to the adjacent surface as previously specified in Article 2.01-C. Submit a sample for approval if requested by Architect.
13. Where specified for custom fabricated equipment, provide compartment with electrical subpanel which shall be pre-wired in conduit concealed in cabinet body construction and connected to all electrical components built into or set upon the counter. Electrical sub-panel shall be UL / ETL / CSA listed, 3-phase, 4-wire circuit breaker type with a ground buss main breaker and individual breakers for each serviced load. Buss shall be copper and the circuit breakers shall be the molded case, bolt-on type with thermomagnetic quick-make, quick-break trip. Multi-pole circuit breakers shall have an internal trip bar. The circuit breakers shall have an interrupting capacity of 10,000 amperes at 120 volts and there shall be a separate breaker for each connected load. Each breaker shall be sized for 125% of the connected load and a minimum of two (2) extra, single pole, 20 amp circuit breakers shall be provided. The loads shall be connected through the breakers in a phased sequence to balance the load on each phase.

B. Water inlets shall be located above the positive water level wherever possible to prevent siphoning of liquids into the water supply system. Wherever conditions shall require a submerged inlet, a suitable type of check valve (except in jurisdictions where check valves are prohibited) and vacuum breaker shall be provided with the fixture to prevent siphoning. Where exposed, piping and fittings shall be chrome-plated. Where vacuum breaker piping is through equipment, provide chrome -plated escutcheon plates to cover holes.
   1. Provide and install indirect waste lines from equipment which will discharge into floor drains or safe wastes, chrome-plated where exposed. Extend to a point at least 1" (25 mm) (or as required by local or state code) above the rim of the floor drain, cut bottom on 45-degree angle and secure in position.
   2. Horizontal piping lines shall be run at the highest possible elevation and not less than 6" (150 mm) above the floor, through equipment where possible.
   3. No exposed piping in or around fixtures or in other conspicuous places shall show tool marks or more than one thread at the fitting.
   4. Steam operating valves on or in fabricated and purchased foodservice equipment shall be provided with composition hand wheels, which shall remain reasonably cool in service.
   5. Provide suitable gas and liquid pressure-reducing valves for equipment with such components that might reasonably be expected to be affected over a period of time by adverse pressure conditions, including but not limited to dishwashers, booster heaters, coffee urns, ranges, steam boilers, etc.

C. Provide and install complete refrigeration systems--charged, started, and operating properly-including, but not limited to:
compressors, condensers, racks, coils, vibration eliminators, sight glasses (moisture indicating type), expansion valves, filters, oil separators, thermostats, defrost time clocks, all controls and control wiring, liquid line driers, piping, and refrigeration grade copper tubing with all sweat joints using Safety-Silv No. 1200 or approved equal silver solder (with as few joints as possible)
   1. Where specifications call for pre-piped lines (i.e., from a fixture to a valve compartment, etc.), provide such work in strict conformance with other sections of the specifications which set forth standards for this type of work or in conformity with the requirements of the ASHRAE Standards or local authorities, whichever is the greater.
   2. Mechanically refrigerated cold pans shall have a normally closed liquid line electric solenoid valve installed before the expansion valve and wired to a silent-type toggle switch complete with an "on-off" red neon light indicator and both mounted in a terminal box on a removable access panel. This switch shall be fed by a separate control circuit and shall not to be wired into the compressor circuit so that it shall stop the flow of refrigerant to the cold pan and not turn off the compressor. The compressor shall then pump down and turn off through the action of the pressure control.
   3. Each refrigeration item specification is written to provide minimum specifications and scope of work. Refrigeration equipment shall be designed and installed to maintain the following general temperatures unless otherwise specified.

a.	Walk-In Refrigerators	1.7°C / 35°F
b.	Walk-In Freezers	-23.3°C / -10°F
c.	Reach-In Refrigerators	1.7°C / 35°F
d.	Reach-In Freezers	-23.3°C / -10°F
e.	Undercounter Refrigerators	1.7°C / 35°F
f.	Undercounter Freezers	-23.3°C / -10°F
g.	Cold Pan	-17.8°C / 0°F
h.	Work Rooms	10°C / 50°F

   4. Provide electrical and refrigeration components needed by the completed system and complete all refrigeration and control connections of and to said components.
   5. Provide evaporator coil defrost system on all walk-in refrigerator and freezer rooms where the refrigeration systems are designed to operate at room temperature of less than 35°F (1.7°C).

6. Verify the requirements of and provide any or all additional refrigeration specialty(s) or component(s) required or recommended by the manufacturer for proper operation under the specific operating conditions and location of each system specified.
7. Verify and provide manufacturer's certification (or certification by manufacturer's authorized agent) that the equipment selection hereinafter specified for each refrigeration system is properly sized and shall meet the operating requirements set forth for each system regarding maintaining specified operating temperature, hours of compressor running time, and system pressures and velocities as recommended by the equipment manufacturer(s).
8. During check-out and initial operation, verify that:
   a. Controls are properly adjusted.
   b. Condensers are equipped with an overload protector.
   c. A competent service mechanic is on site during the first eight (8) hours of operation.
   d. Switches, starters, and controls are identified as to function.
9. Unless otherwise specified, furnish thermometers for walk-in units mounted above the exterior entrance door with suitable length armored capillary tubes to allow the sensing bulbs to be installed in the incoming air stream to the blower coil with runs fastened to the walk-in walls to prevent it from damage. This identical requirement applies to alarm systems when specified.

2.5 PRODUCT SPECIFICATIONS

A. Refer to Part 4 for complete itemized product specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Begin installing the equipment at the time the building is ready to receive the equipment and in accordance with the schedule.

B. Provide a competent foreman or supervisor for erection of equipment and to coordinate with other trades regarding connections, installation, and inspection. Coordinate delivery schedule to ensure adequate openings in the building to receive the equipment.

C. Install refrigeration work in an approved manner, using first quality fittings, controls, valves, etc. Refrigeration items shall be started up, tested, adjusted, and turned over to the Architect in first-class condition and left operating in accordance with the manufacturer's specifications.

D. Set equipment that rests on masonry bases level onto a bed of silicone rubber sealant.

E. Seal equipment that butts to a wall or against other equipment with silicone rubber sealant. Set trim strips or other items requiring fasteners in a bed of silicone rubber sealant and fastened with suitable stainless steel fasteners 48" (1200mm) or less on centers. , surfaces shall be thoroughly clean and degrease all surfaces prior to the application of sealant.

F. Install and interconnect electrical controls, switches, or other units which are separately furnished for field installation in or on equipment provided, unless otherwise specified.

G. Install and wire refrigeration systems in strict conformance with the manufacturers' instructions and recommendations. Ensure that all refrigeration condensing units are ventilated properly and are accessible for repair, maintenance, and inspection.

H. Hang evaporator coils per the manufacturer's recommendation at the locations as shown on the drawings. Mount units such that the drain pans are pitched to the drain lines. Hang the coils using nylon or other approved non-conductive, non-corrosive fasteners Furnish #12 gauge galvanized steel fish plates of suitable size and shape on the exterior ceiling of the walk-in to

spread the weight of the coils adequately. Connect coils to the condensing unit and install to constitute a complete working system capable of maintaining the interior temperatures specified regardless of the heavy usage the walk-in units may receive.

I. Furnish and install a copper or PVC drainline painted silver from each coil outlet to a point 1" (25mm) above the floor drain. Trap drainlines immediately above the floor drain. Provide continuous electrified heater tape for freezer drainlines, coordinate electrical requirements and wiring with electrical division. Insulate drainline after installation.

J. Refrigeration tubing shall be the Type L, ACR hard drawn degreased, sealed copper and shall be installed with horizontal runs sloped 1" per 20 feet (1:240) toward the condensing units. Refrigerant piping shall be properly supported by adjustable hangers spaced and adjusted to the drop required. Where vertical runs of more than 5' (1500mm) occur in the suction line, trap the risers at the bottom. Install piping so that refrigerant or oil cannot drain back into the coils from the suction line.

K. Insulate suction and refrigerant lines with minimum 1/2" (13mm) Armstrong armaflex or equal cellular type insulation. Provide metal pipe sleeves where piping passes through a wall, ceiling, or floor. Fill space around the tubing with mastic insulating compound. Install a permanent suction line filter in each compressor suction line with pressure fitting ahead of the filter to facilitate checking of pressure drop through the filter. Fully insulate and seal penetrations through walk-in cooler or freezer structures to be vapor tight to prevent condensation within any light fixtures, switch boxes, junction boxes, or any other fittings. Fully seal refrigeration and drain lines and provide escutcheon plates.

L. Furnish and completely install a thermostat to control the refrigeration temperatures for each individual compartment.

M. Mount the condensing units on a welded steel rack containing all accessories and components necessary to form a complete condensing unit package. Provide each condensing unit with a factory mounted, pre-wired control panel/disconnect switch complete with circuit breakers, contactors, and time clocks as required.

N. Furnish the refrigeration systems with a one-year refrigeration service contract, covering all parts and labor, with service available seven days per week, 24-hours per day. Provide an option for continuation of the service contract after the first year.. Warrant the refrigeration system for one year and provide the compressors with the manufacturer's extended five-year warranty.

O. Furnish four (4) copies of complete remote refrigeration system control wiring and piping diagrams. Frame one (1) copy in Plexiglas and mount at compressor location or inside the refrigeration system enclosure as appropriate.

P. Coordinate the equipment work with the respective work of other Sections so that electrical and mechanical components built into the equipment will conform and/or adapt to the type, materials, and characteristics of the building components.

Q. Install heated and motor-driven equipment so as to operate efficiently. Provide additional vents, guards, deflectors, and other accessories as needed at no additional cost. Note such additions or modifications on the shop drawings and bring to Architect's attention by special accompanying letter.

3.2 FABRICATION

A. Items of fabricated equipment shall be fabricated in the same factory and shall be similar in construction details, materials, methods, and appearance to similar types of items so fabricated under this contract.

B. Each fabricated item of equipment shall include necessary reinforcing, bracing, and welding with the proper number and spacing of uprights and cross members for strength. Wherever standard

sheet sizes will permit, the tops of all tables, shelves, exterior panels of cabinet type fixtures, and doors and drainboards shall be constructed of a single sheet of metal. Except where required to be removable, flat surfaces shall be secured to vertical and horizontal bracing members by welding or other approved means to eliminate buckle, warp, rattle, and wobble. Equipment not braced in a rigid manner and which is subject to rattle and wobble shall be unacceptable, and the Contractor shall add additional bracing in an approved manner to achieve acceptance.

C. Suitable pipe slots shall be provided on fabricated equipment to accommodate service and utility lines and mechanical connections. These slots shall be of proper size and shall be neatly made with turned up edges around to eliminate cutting or defacing of equipment on the job. Cabinet bases shall be provided with an inner panel duct at the ends or rear of the cabinet allowing adequate space to conceal vertical piping. Such work, when performed at the job site, shall be of the same quality as similar work performed in the shop.

D. Exposed surfaces shall be free from bolt and screw heads. When bolts are required, they shall be of the concealed type and be of similar composition as the metal to which they are applied. Where bolt or screw threads on the interior of fixtures are visible or may come into contact with hands or wiping cloths, they shall be capped with a stainless steel acorn nut and stainless steel lock washer.

E. Where screw threads are not visible or readily accessible, they shall be assembled with stainless steel lock washers and nuts. Wherever bolts or screws are welded to the underside of trim or tops, the reverse side of the weld shall be finished uniformly with the adjoining surfaces. Depressions at these points shall not be acceptable.

F. Rivets shall not be permitted in any location.

G. Welding shall be the heliarc method with welding rod of the same composition as the sheets or parts welded. Welds shall be complete, strong, and ductile with excess metal ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of mechanical imperfections such as gas holes, pits, cracks, etc., and shall be continuously welded so that the fixtures shall appear as one piece construction. Butt welds made by spot solder and finished by grinding shall not be acceptable.
   1. Spot welds shall have a maximum spacing of 3" (75mm). Tack welds shall be of at least 1/4" (6mm) length of welding material at a maximum space of 4" (100mm) from center to center. Weld spacing at the ends of the channel battens shall not exceed 2" (50mm) centers.
   2. In no case shall soldering be accepted.
   3. Fixtures shall be shop fabricated of one piece and shipped to the job completely assembled wherever possible. Equipment too large to transport or enter the building as one piece shall be constructed so that the field joints can be welded at the job site.
   4. Exposed joints shall be ground flush with adjoining material and finished to harmonize therewith. Whenever material has been depressed by a welding operation, such depression shall be suitably hammered and peened flush with the adjoining surface and, if necessary, again ground to eliminate low spots. In all cases, the grain of rough grinding shall be removed by successive fine polishing operations.
   5. Unexposed welded joints on undershelves of tables or counters in stainless steel construction shall be suitably coated at the factory with an approved metallic-based paint.
   6. After galvanized steel members have been welded, welds and areas where galvanizing has been damaged shall have a zinc dust coating applied in conformance with U.S. Government Military Specification Number MIL-P-26915.

H. Butt joints and contact joints, wherever they occur, shall be close fitting and shall not require filler. Wherever break bends occur, they shall be free of undue extrudence and shall not be flaky, scaly, or cracked in appearance; where such breaks do mar the uniform surface appearance of the material, such marks shall be removed by suitable grinding, polishing, and finishing. Wherever sheared edges occur, they shall be free of burrs, fins, and irregular projections and be finished to obviate danger of cutting or laceration when the hand is drawn over

them. In no case shall overlapping materials be acceptable where miters or bullnosed corners occur.

I. The grain of polishing shall run in the same direction on horizontal and on vertical surfaces of each item of fabricated equipment except in the case where the finish of the horizontal sections of each shall terminate in a mitered edge. Where sinks and adjacent drainboards are equipped with backsplash, the grain of polishing shall be consistent in direction throughout the length of the backsplash and sink compartment.

J. Component parts, whether fabricated by the Contractor or purchased for building into the fabricated equipment, shall conform to the following.

K. Bolts, screws, nuts, and washers shall be of steel, except where brass or stainless steel is fastened, in which case they shall be of brass or stainless steel, respectively. Where dissimilar metals are fastened, bolts, screws, nuts, and washers shall be of the higher-grade metal. The spacing and extent of bolts and screws shall be such as to ensure suitable fastening and prevent buckling of the metals fastened.

L. Adequate ventilation is to be provided for custom fabricated equipment with built-in or drop-in integral refrigeration systems.

3.3 CLEAN-UP

A. At completion of the installation, clean up, lubricate, and adjust where necessary items of equipment provided and turn them over in first-class condition.
   1. Where stainless steel surfaces are disturbed by the installation or fabricating process, such surface shall be finished to match adjoining undisturbed surfaces.
   2. At the completion of the installation work, stainless steel shall be gone over with a portable polishing machine and buffed to perfect surfaces. Painted surfaces shall be carefully gone over and retouched as required.

3.4 START-UP AND TESTING AND COMMISSIONING

A. Startup Services: Engage factory-authorized service representatives to perform startup services and to demonstrate and train Owner's maintenance personnel as specified below.
   1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized.
   2. Remove protective coverings and clean and sanitize equipment, both inside and out, and relamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.
   3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.
   4. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.
   5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   6. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
   7. Test water, drain, gas, steam, oil, refrigerant, and liquid-carrying components for leaks. Repair or replace leaking components.
   8. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance for each food service equipment item.

9. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
10. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
11. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

3.5 SEISMIC RESTRAINTS

A. Install equipment in these contract documents according to the "SMACNA Guidelines for Seismic Restraint of Kitchen Equipment" in any State, province, or jurisdiction that has legislated this requirement as necessary for acceptance. This shall include:
   1. Identifying these items on his submittal drawings, Plans, Elevations, and Sections.
   2. Showing required SMACNA methods of restraint on his submittal drawings.
   3. Referencing the appropriate detail(s).
   4. Obtain regulatory approval for all seismic engineering details.

B. If no SMACNA detail exists for a particular situation, prepare and obtain approval for a special attachment detail:
   1. Detail must be prepared by an engineer licensed by the State having jurisdiction over the project and accompanied by the supporting calculations used in the design.
   2. Verify that the restraint design is appropriate to the building's structural conditions and the surfaces to which the equipment will be secured.

PART 4 - ITEMIZED PRODUCT SPECIFICATIONS

A. PHASE 1 EQUIPMENT LIST

ITEM #01 PLASTIC SHELVING UNIT
Manufacturer: Cambro
Model: CPU Premier Series
Camshelving Premier Starter Unit, width x Length per plan x 72"H, 5 shelf, includes: four posts, 2 sets of post connectors, traverses
Five (5) tier; four (4) vented shelves plus one (1) solid bottom shelf, speckled gray, NSF

ITEM # 06 FAUCET, BACKSPLASH MOUNTED
Manufacturer: Fisher or equal by T&S or Chicago Faucet
Model: 13269
Faucet, backsplash mount, 8" centers, 12" swing spout, lever handles with color coded indexes, 1/2" NPT male inlets, brass, CSA, ADA Compliant
1 year warranty against defects in materials or workmanship, standard
Shipped loose to plumber to install on site

ITEM # 07 LEVER WASTE W/ OVERFLOW
Manufacturer: Fisher or equal by T&S or Chicago Faucet
Model: 22322
DrainKing Waste Valve, flat strainer, overflow body, 14 x 16 tube & elbow, 12 GPM drain rate, cast red brass body
Shipped loose to plumber to install on site

ITEM # 12 HD RANGE-SIX BURNER
Manufacturer: Southbend or equal by Garland or Vulcan
Model: P36D-BBB

Platinum Heavy Duty Range, gas, 36", (6) 35,000 BTU open burners, manual controls, (1) standard oven, includes (2) racks, stainless steel front, sides, exterior bottom & 6" adjustable legs, 255,000 BTU, CSA, NSF

Standard (2) years limited parts and labor warranty
Natural Gas
Natural Gas pressure regulator
Platinum Backguard/Flue Riser, 24" H x 36" W, without shelves, stainless steel front & sides
Stainless rear, for riser 24" high, 36" wide
Casters, 2 locking & 2 standard, in lieu of legs

Dormont Blue Hose™ Moveable Gas Connector Hose Assembly, 1" inside dia., 60" long, covered with stainless steel braid, coated with blue antimicrobial PVC, 1 SnapFast® QD, 2 Swivel MAX®, 1 pair Safety Set® with adhesive foam tape and hardware mounting options, limited lifetime warranty

ITEM # 20 EXHAUST HOOD-60”Lx48”DX24”H
Manufacturer: Halton or equal by Streivor, Gaylord or Avtec
Model: Capture Jet

Stainless steel matching enclosure panels from the top of the Hood to the finished ceiling to be furnished by KEC. (Verify ceiling height with plan.)

KEC shall provide 20 gauge stainless steel wall sheathing to extend from the top of the floor base to the bottom of the rear edge of the hood, the full length of the hood and extending to the side walls where so installed. Sheathing shall be maximum practical size and trimmed with Component Hardware joining and end strips. Pre-cut holes for utilities to minimize field cutting. All holes to be trimmed with chrome-plated escutcheon plates. Finish to match exhaust hood.

Reference foodservice drawing FS5.01 for additional details

ITEM # 22 FIRE SUPPRESSION SYSTEM
Manufacturer: Ansul Fire Protection
Model: R102

Furnish and install a complete, fully operational wet chemical automatic fire extinguishing system to provide surface, duct and plenum protection in conformance with NFPA-96 and local code requirements. All exposed components shall be chrome plated. Field installation of system shall done by a trained and authorized distributor. No exposed piping is acceptable with the exception of appliance drops (if applicable). Appliance drops shall be chrome-plated or stainless steel. Furnish mechanical gas shut-off valves (verify size) and provide to Plumber on site for installation.

Provide a Y Strainer that is approved for the mechanical removal of solids from pressurized gas lines which can be installed in a horizontal or vertical position. The Y Strainer to be manufactured of Carbon Steel and include a removable type 304 stainless steel Strainer with .016 inch perforations (#40 mesh). The Y Strainer to include a removable cap that allows the Strainer to be removed for inspection and/or cleaning when the gas line is not pressurized.

Coordinate with Division 22 (Plumbing) for the Y Strainer size and ANSI flanged or threaded pipe connection specifications. Division 22 to install the Y Strainer in accordance with the installation instructions.

System shall be complete in all respects, including remote manual activation device, mechanical gas solenoid valve, and provision for connection to a remote notification device.

Verify location with foodservice drawings

System shall be sized to accommodate phase 1 and phase 2 exhaust hoods

ITEM # 23 HAND SINK
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: HSA-10-1FK
Hand Sink, wall mount, 13-1/2"Wide x 9-3/4" front-to-back x 6-3/4" deep bowl, 304 stainless steel construction, splash mounted faucet, single knee pedal, skirt, basket drain, deep-drawn seamless design-positive drain, inverted "V" edge, NSF
Tempering Valve, built in check valve, ASSE 1016 & 1070 listed
Left & right-side splashes
Faucet and drain shipped loose to plumber to install on site
Paper Towel and Soap Dispensers to match buildings existing dispensers

ITEM # 34 WORK TABLE W/ SINK, 96”x30”
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: T3096STE-BS
Work Table, open base, 96"W x 30"D x 34”H, 14/304 stainless steel top with 6" backsplash and sides turned down 90 degrees, square front edge, square turndown ends, heavy gauge stainless steel 1-1/4" O.D. side & rear crossrails, (6) 1-5/8" O.D. legs, 1" adjustable stainless steel bullet feet, Uni-Lok® system, NSF
Provide 1” turndown at backsplash
Secure the worktable to the wall using 16ga. Stainless steel “Z” clips
Square edge table, front and/or rear, per table
Fabricated sink welded in place, 16" x 20" x 14" bowl
Stainless steel bullet feet
All welded construction, legs, undershelf & top
Side splash enclosed if exposed

ITEM # 44 BEVERAGE COUNTER
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: BEV3072SEM-10BS/R
Spec-Master® Marine Series Beverage Counter, 72"W x 30"D, 14/304 stainless steel top, 10"H backsplash with NEMA 5-20R receptacle, box marine edge on front & sides, sink on right with deck mount faucet, urn trough on left with louvered insert & 1-1/2" drain, (2) hinged doors on front, 8" OC rack slides for (3) glass racks, Uni-Lok® gusset system, includes Z-clip wall mounting brakcet, stainless steel cabinet, legs, & adjustable bullet feet, NSF
18/304 cabinet base
Provide 1” turndown at backsplash
Secure the worktable to the wall using 16ga. Stainless steel “Z” clips

ITEM # 51 THREE COMPARTMENT SINK
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide

Model: FN2860-3-20-14/3

Spec-Master® FN Series Sink, three compartment, 126"W x 35"D, 14/304 stainless steel top, coved corners, 20" wide x 28" front-to-back x 14" deep compartments, 20" drainboards on left & right, 9-1/2"H backsplash, (2) sets of 8" OC splash mount faucet holes, rolled edges on front & sides, includes 3-1/2" basket drains, stainless steel crossbracing on all sides, stainless steel legs & adjustable bullet feet, NSF

Provide 1” turndown at backsplash
Secure the worktable to the wall using 16ga. Stainless steel “Z” clips
Individual fabricated sink bowls welded in place-14/304
All welded construction
Side splash when located next to wall

ITEM # 61.1 MOP SINK CABINET

Manufacturer: Advance Tabco IEI or equal by Nationwide, IMC Teddy, Eagle, AERO, John Boos, or Universal Stainless

Model: 9-OPC-84DL

Cabinet with Mop Sink, 50-3/8"W x 22-3/4"D x 84"H O.A., double hinged doors, left side mop sink 20"W x 16"D front to back x 12" deep (drain included), storage for mop bucket to roll in on right, (2) mop holders, (4) fixed intermediate shelves (3 on right, 1 on left above sink), slotted side panels for ventilation, 16/304 series stainless steel sink bowl, 18/304 series sink bowl apron, 18/430 series stainless steel cabinet, NSF

Back panel for mop sink cabinet, type 300 stainless steel
Additional fixed mid shelf for mop sink cabinet
Service Sink Faucet, wall mount, 8" OC, 6-1/2" spout, with hose thread & pail hook, vacuum breaker spout, wall braced, chrome-plated brass
Door lock, one required for each hinge door or for each set of sliding doors

ITEM # 64.2 WATER FILTRATION SYSTEM

Manufacturer: Everpure or equal by 3M or OptiPure

Model: EV932523

INSURICE Triple PF-i4000² System, 36,000 gallon capacity, 5 gpm flow rate, 0.5-micron precoat filtration (3) I4000² Cartridges, with self-contained scale inhibitor feed (1) EC210 sediment prefilter Cartridge, pressure gauge, flushing valve, high flow rate 5.0 gpm

ITEM # 68 SHELVING, WALL-MOUNTED, 120”x12”

Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide

Model: WS12120-14/3

Shelf, wall mount, 120"W x 12"D, rolled frontedge, 1-1/2" upturn on rear & ends, includes stainless steel mounting brackets stud welded to shelf, 14/304 stainless steel construction, NSF

Two tier, mount first at 54” AFF

ITEM # 77.1 TRASH CAN W/ DOLLY – BY OWNER

NIKEC - This is not in the kitchen equipment contract and is shown here for informational purposes only. General Contractor to confirm all required utilities are provided.

ITEM # 100 FRONT COUNTER, STAINLESS STEEL

Manufacturer: Custom

Constructed in accordance with the front end specifications and drawings.

14/304 top; 18 ga/304 stainless steel legs.
All welded construction
Provide cut-outs drop-in equipment, food shields and POS cable holes (with grommets)

ITEM # 105.1 WARMING DRAWER,
Manufacturer: Hatco or equal by FWE
Model: HDW-2

Warming Drawer Unit, Free Standing, narrow, two drawers, includes (1) standard 6" deep food pan per drawer, stainless steel construction, thermostatic controls, 4" legs, NSF, cULus, Made in USA

2-yr warranty on drawer warmer heating elements against burnout, standard
2-yr warranty on drawer slides & rollers against breakage, standard
Stainless Steel Drawer Front, standard
Casters, 5 diameter, two swivel; two locking

ITEM # 106 CASH REGISTER/POS SYSTEM-BY FOODSERVICE OPERATOR

NIKEC - This is not in the kitchen equipment contract and is shown here for informational purposes only. General Contractor to confirm all required utilities are provided.

ITEM # 108 MENU BOARD

NIKEC - This is not in the kitchen equipment contract and is shown here for informational purposes only. General Contractor to confirm all required utilities are provided.

ITEM # 109 BACK COUNTER, STAINLESS STEEL
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: CUSTOM

Cabinet base with sliding doors, length per plan x 30"D x 34”H, 14/304 stainless steel top with 6" backsplash and sides turned down 90 degrees, square front edge, square turndown ends, 18 ga 304 stainless steel base, sliding doors, 6”H stainless steel legs, adjustable stainless steel bullet feet, NSF

Splash shall be 6”H x 2”D with 45 degree return and turndown at wall.
Secure the counter to the wall using 16ga. Stainless steel “Z” clips
NO visible screws
Provide matching side splash at walls
Square front edge
Center shelf full width for enclosed base worktables
All welded construction
Matching side splash at all walls

Reference foodservice drawing FS101SC for additional details

ITEM # 116 BOTTLED BEVERAGE REFRIGERATOR-ONE DOOR-BY VENDOR

NIKEC - This is not in the kitchen equipment contract and is shown here for informational purposes only. General Contractor to confirm all required utilities are provided.

ITEM # 117 NACHO CHEESE DISPENSER-BY VENDOR

NIKEC - This is not in the kitchen equipment contract and is shown here for informational purposes only. General Contractor to confirm all required utilities are provided.

ITEM # 131 PASS-THRU SHELF
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: Custom

Shelf, pass-thru, width per plan x 24"D, 12" maximum wall thickness, square edge, 16/304 stainless steel construction

KEC to frame opening in 18 ga. Stainless steel, provide 1” returns around perimeter of opening, Provide fully welded corners

Reference foodservice drawing FS101SC for additional details

ITEM # 141.1 BUN/SHEET PAN RACK
Manufacturer: Channel Manufacturing
Model: 430A

Model 430A Bun Pan Rack, Under-Counter, mobile, 20-1/2"W x 26"D x 32"H, front load, open sides, 3" spacing, capacity (8) 18" x 26" bun pans, aluminum construction, 5" swivel stem casters, NSF, Made in USA

ITEM # 152 WALK-IN COOLER (FREEZER SECTION FUTURE PURCHASE)
Manufacturer: ThermalRight, or equal by Bally, ThermolCool
Model: CUSTOM

Per plan x 8’-6”H
4” urethane insulation, minimum value R-25, for the cooler.
4” urethane insulation, minimum value R-32, for the freezer.
NSF & UL approved construction
Interior vertical panels finished with stucco embossed .040 aluminum

Floorless unit- Coordinate the recessed insulated slab with G.C.

Interior ceiling panels to be smooth white aluminum finish
Unexposed exterior vertical and ceiling panels to be stucco embossed galvanized
Exposed exterior vertical panels to be stucco embossed .040 aluminum with 1/8” thick aluminum diamond tread plate for 48” high wainscoting.
Doors:
- 36”W x 76” high; three hinges; Provide a vinyl curtain
- 48”H 1/8” thick aluminum tread plate inside and out; 14” x 24” observation window. Provide inside safety release.
- Provide backing above cooler door for mounting of air curtain.
- Provide Modularm 75LC for each door for light and alarm control, recessed into panel.
- Automatic door closer

1/8” thick aluminum tread plate for 48” high wainscoting full interior.
Provide 4’-0” LED light fixture(s) as shown on foodservice plans. Must meet health department and 2009 standards with efficacy of no less than 40 lumens per watt.
Matching trim strips and enclosure panels as required to adjacent walls and ceiling.
Provide complete refrigeration system. Provide on-demand defrost on freezer system.

Walk-ins and refrigeration to meet requirements of the Energy Security and Independence Act of 2007 and the Department of Energy’s Walk-in Cooler and Freezer ruling of 2017.

Reference foodservice drawing FS503 for additional details

ITEM # 152.1 EVAPORATOR COIL-COOLER
Included with item #152.

Reference foodservice drawing FS503 for additional details

ITEM # 152.2 COMPRESSOR-COOLER
Included with item #152.

Reference foodservice drawing FS503 for additional details

ITEM # 152.3 EVAPORATOR COIL-FREEZER
Future purchase, coordinate electrical requirements

Reference foodservice drawing FS503 for additional details

ITEM # 152.4 COMPRESSOR-FREEZER
Future purchase, coordinate electrical requirements

Reference foodservice drawing FS5.03 for additional details

ITEM # 154 HAND SINK, DROP-IN
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: SR10-14-9.5-1
Self-Rimming Drop-In Sink, one compartment, 10" wide x 14" front-to-back x 9-1/2" deep bowl, 4" OC deck mount faucet with gooseneck spout (302004), includes basket drain, 18/304 stainless steel construction, NSF
Provide and coordinate soap and paper towel dispensers with owner, G.C. to install

ITEM # 195 LEVER WASTE
Manufacturer: Fisher or equal by T&S or Chicago Faucet
Model: 22209
DrainKing Waste Valve, with flat strainer, 12 GPM drain rate, dual teflon seals, stainless steel ball, cast red brass body
Shipped loose to plumber to install onsite

ITEM # 220 COUNTERTOP HOT FOOD WELL, ONE PAN
Manufacturer: Wells
Model: SMPT
Food Warmer, countertop, electric, one 12" x 20" pan opening, wet/dry operation, thermostatic controls, stainless steel construction, with cordset & 4" legs, UL, CE
Limited 3 year parts & labor warranty, standard

The KEC is to coordinate with the millwork contractor/fabricator to ensure that the counter design meets the manufacturers ventilation requirements.

ITEM # 233.1 HEATED LAMP
Manufacturer: Hatco
Model: GRAH-30

Glo-Ray® Infrared Foodwarmer, 30" W, high wattage, tubular metal heater rod, single heater rod housing, aluminum construction, 660 watts, NSF, cULus, Made in USA
Remote Control Enclosure, (1) toggle switch

ITEM # 290 ICE MAKER
Manufacturer: Hoshizaki
Model: KM-1900SAJ3
Ice Maker, Cube-Style, 48"W, stackable, air-cooled, self-contained condenser, production capacity up to 1865 lb/24 hours at 70°/50° (1675 lb AHRI certified at 90°/70°), crescent cube style, stainless steel exterior, R-404A refrigerant, NSF, UL, ENERGY STAR®
Warranty: 3-Year parts & labor on entire machine
Warranty: 5-Year parts & labor on evaporator
Warranty: 5-Year parts on compressor & air-cooled condenser
Mount on top of ice bin

Provide water test and verify Water Filtration System, item # 64.2

Confirm ceiling height so that all necessary clearances are met

ITEM # 403 FLOOR TROUGH, 36”x24”
Manufacturer: IMC/Teddy or equal by Eagle or Advance Tabco
Model: ASFT-2436-SG
ASFT Anti-Spill Floor Trough, 36"W x 24"D, 6" deep receptacle, (1) 4" OD tailpiece, stainless steel beehive strainer, 14/304 stainless steel, brushed satin finish, (SG) subway grating, NSF, Made in USA

ITEM # 503 ICE BIN W/ TRANSPORT CART
Manufacturer: Follett Corporation
Model: DEV1650SG-60-75
Ice-DevIce™ with SmartCART™ 75, 1660 lb. bin storage capacity, with front chute, poly liner, SmartGATE ice shield, poly door with PowerHinge™ door hinge, full stainless steel exterior and base, ABS/poly top custom cut for ice machine, includes 82 oz plastic ice scoop, paddle and rake set, and (1) polyethylene cart with hinged lid and (3) polyethylene Totes ice carriers, each carrier holds 25 lb/75 lb total per cart, for cube or Chewblet ice only, NSF
5 year parts & labor warranty, standard

Provide any necessary top reinforcement to mount ice maker on top of bin.

ITEM # 544 SANDWICH/SALAD PREPARATION REFRIGERATOR
Manufacturer: Continental Refrigerator
Model: D48N12-FB-D
Designer Line Sandwich Unit, Front Breather, 48"W, two-section, (12) 1/6 size x 4" deep pans with 12" cutting board, (4) drawers, accommodates (1) 12 x 18 x 6 pan per drawer or (1) 1/2 x 6 pan & (1) 1/3 x 6 pans per drawer capacity (supplied by others), stainless steel top, front, sides & interior, electronic control with digital display, hi-low alarm, 3-3/4" casters, rear mounted self-contained refrigeration, automatic hot gas condensate evaporator, R290 Hydrocarbon Refrigerant, 1/4 hp, cETLus, NSF, Made in USA
Warranty: 3 year parts and labor; 5 year compressor
Stainless steel flat cover, Standard/C-Tops

The working height of the refrigerator is match the working height of the adjacent countertop.

END OF PHASE 1 SPECIFICATION

B. PHASE 2 EQUIPMENT LIST

ITEM #01 PLASTIC SHELVING UNIT
Manufacturer: Cambro
Model: CPU Premier Series

Camshelving Premier Starter Unit, width x Length per plan x 72"H, 5 shelf, includes: four posts, 2 sets of post connectors, traverses

Five (5) tier; four (4) vented shelves plus one (1) solid bottom shelf, speckled gray, NSF

ITEM # 10.1 TILTING SKILLET BRAISING PAN - 30 GALLON
Manufacturer: Market Forge or equal by Groen or Cleveland
Model: 30P-STGM

Tilting Skillet, gas, 30 gallon capacity, 9.5" deep skillet pan with etched gallon markings, modular enclosed cabinet base, standard with manual tilt mechanism, spring assist cover, stainless steel pan and frame, 93,000 BTU, CSA Flame, CSA Star, NSF

Natural gas
Draw Off, 2" tangent with strainer
Draw-Off Strainer, 2"
Provide heavy duty double pantry faucet- ¾" water inlets in lieu of standard ½" with brackets and plumbing

Dormont Blue Hose™ Moveable Gas Connector Hose Assembly, 3/4" inside dia., 60" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (2) Swivel MAX®, (1) Snap'N Go, coiled restraining cable with hardware, 140,000 BTU/hr minimum flow capacity

Dormont Hi-PSI® Water Connector Hose, 3/4" dia., 60" long, covered with stainless steel braid, coated with gray antimicrobial PVC, brass two-way Quick Disconnect coupling, max pressure: 150psig, 2-year warranty

ITEM # 14 A&B COMBI OVEN, DOUBLE STACK
Manufacturer: Alto-Shaam or equal by Rational or Convotherm
Model: CTP7-20G/CTP7-20G

Combitherm® CT PROformance™ Combi Oven/Steamer, gas, boiler-free, countertop, (8) 18" x 26" full size sheet or (16) 12" x 20" full size hotel pan (1/1 GN) capacity, PROtouch control with steam/convection/combi and retherm cooking modes, programmable cool-down, SafeVent™ steam venting, removable single-point temperature probe, (3) power levels, (4) cooking modes, CombiClean PLUS™ with (5) cleaning levels, (2) side racks with (8) non-tilt support rails, CoolTouch3™ glass window, door hinged right, high efficiency LED lighting, stainless steel construction, adjustable stainless steel legs, 98,000 BTU, EcoSmart®, cULus, UL EPH Classified, CE, IPX5, Gastec, ENERGY STAR®, EAC

Start up by Manufacturer provided/authorized installation.
Provide a training program by a Serve Safe certified culinary chef to consist of one (1) day startup showing all equipment and how it works with demonstrations.
Natural gas
Combi Oven/Steamer Unit, without CombiSmoker option, standard
Provide cord or plug
Single-point removable probe
Automatic Liquid Cleaning System with removable support tray
Stacking Hardware, 7-20E or 7-20G over 7-20G
Mobile Stacking Base, for stacking on 7-20 model ovens

Installation Kit, for gas CTP or CTC combi ovens, rated up to 30.0 amps, per oven

ITEM # 21 EXHAUST HOOD-132”Lx66”DX24”H
Manufacturer: Halton or equal by Streivor, Gaylord or Avtec
Model: Capture Jet

Stainless steel matching enclosure panels from the top of the Hood to the finished ceiling to be furnished by KEC. (Verify ceiling height with plan.)

KEC shall provide 20 gauge stainless steel wall sheathing to extend from the top of the floor base to the bottom of the rear edge of the hood, the full length of the hood and extending to the side walls where so installed. Sheathing shall be maximum practical size and trimmed with Component Hardware joining and end strips. Pre-cut holes for utilities to minimize field cutting. All holes to be trimmed with chrome-plated escutcheon plates. Finish to match exhaust hood.

Reference foodservice drawing FS502 for additional details

ITEM # 30 SHELVING, WALL-MOUNTED, 96”x12”
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: WS1296-14/3

Shelf, wall-mounted, 96"W x 12"D, rolled frontedge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 14/304 stainless steel construction, NSF
Two Tier, first shelf mounted 54” AFF

ITEM # 32 MEAT SLICER, AUTOMATIC
Manufacturer: Hobart or equal by Globe or Berkel
Model: HS9-1

Heavy Duty Meat Slicer, automatic, 13" CleanCut™ removable knife with removal tool, anodized finish with (6) interlocks, (3) stroke lengths & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, product fence, single action top mounted sharpener with Borazon™ stones, manual lift lever, 1/2 hp motor, NSF cETLus
Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
Knife removal tool for HS slicer with removable knife feature

ITEM # 36 COFFEE BREWER
Manufacturer: FETCO or equal by Bunn or Curtis
Model: CBS-52H-20

Handle Operated Series Coffee Brewer, twin, 2.0 gallon capacity, automatic, on/off switch, two-portion standard, gravity flow dispense tube system, programmable recipes, gourmet coffee brew basket Locks During Brew Cycle, hot water service, tank drain, UL, cUL, NSF
Circuit board: 3 year parts & 1 year labor warranty, standard
Electro-mechanical parts: 2 year parts & 1 year labor warranty, standard
All other parts: 1 year parts & 1 year labor warranty, standard
Electric configuration C53046- 3 x 4.0KW heaters
Three (3) extra L3D-20 LUXUS® Thermal Dispenser, 2.0 gallon, Freshness Timer®, Volume Indicator™, vacuum insulated, flip & hide fill-through lid, base with built-in handles and drip tray
1 year parts warranty, standard
Black dispenser faucet, std.

Everpure® In-Line Water Filtration System, includes: filter head, connector hose, cartridge, & mounting hardware

ITEM # 53.4 PRE-RINSE FAUCET ASSEMBLY
Manufacturer: Fisher
Model: 2110-WB

Pre-Rinse Assembly, single-deck dual control valve, with spring action flexible gooseneck, 21" riser, 36" hose, wall bracket & Ultra-Spray™/PLUS spray valve (1.15 gallons per minute @ 60 PSI)

Shipped loose to plumber to install on site

ITEM # 97 DISHWASHER, DOOR TYPE, VENTLESS
Manufacturer: Hobart or equal by Champion or Insinger
Model: AM15VL-2

Ventless Door Type Dishwasher, Energy Recovery, hot water sanitize, internal condensing system, 40 racks/hr, Straight-thru or corner, solid-state controls with digital status, booster heater, electric tank heat, auto-fill, stainless steel tank, doors & feet, ENERGY STAR®, Free factory startup for installations within a 50 mile radius of a Hobart service office; installation beyond 50 miles will be charged at the quoted rate by the local Hobart service office

Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
Two (2) Combination rack
Two (2) Peg rack
Single point electrical connect AM15 kit
Drain water tempering kit

ITEM # 111 REACH-IN REFRIGERATOR-ONE DOOR
Manufacturer: Continental Refrigerator or equal by Victory, Beverage Air or True
Model: 1RNSA

Refrigerator, reach-in, one-section, 20 cu. ft., self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, electric condensate evaporator, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF, Made in USA, ENERGY STAR®

Door hinged per plan
Casters, swivel, with brakes (5" diameter rubber tires) set of 4 (6" height)
Two (2) extra shelves per section, epoxy coated, plated steel with clips

ITEM # 113 REACH-IN FREEZER- ONE DOOR
Manufacturer: Continental Refrigerator or equal by Victory, Beverage Air or True
Model: 1F-SA

Freezer, reach-in, one-section, 20 cu. ft., self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth, full-height door, cylinder lock, electronic control with digital display, hi-low alarm, electric condensate evaporator, 1/3 HP, cETLus, NSF

Door hinged per plan
Casters, swivel, with brakes (5" diameter rubber tires) set of 4 (6" height)
Two (2) extra shelves per section, epoxy coated, plated steel with clips

ITEM # 152 WALK-IN FREEZER SECTION (FUTURE PURCHASE)
Manufacturer: ThermalRight, or equal by Bally, ThermolCool
Model: CUSTOM

Per plan x 8’-6”H
4” urethane insulation, minimum value R-25, for the cooler.
4” urethane insulation, minimum value R-32, for the freezer.
NSF & UL approved construction
Interior vertical panels finished with stucco embossed .040 aluminum

Heavy duty structural floor design with internal support structure 12” o.c, with a ¾” thermalite overlay, 4” urethane insulation, minimum value R-28. The interior floor surface shall be foamed-in-place 1/8” aluminum tread plate with coved interior corners.
Interior ramp with non-skid strips

Interior ceiling panels to be smooth white aluminum finish
Unexposed exterior vertical and ceiling panels to be stucco embossed galvanized
Exposed exterior vertical panels to be stucco embossed .040 aluminum with 1/8” thick aluminum diamond tread plate for 48” high wainscoting.
Doors:
- 36”W x 76” high; three hinges; Provide a vinyl curtain
- 48”H 1/8” thick aluminum tread plate inside and out; 14” x 24” observation window. Provide inside safety release.
- Provide backing above cooler door for mounting of air curtain.
- Provide Modularm 75LC for each door for light and alarm control, recessed into panel.
- Automatic door closer

1/8” thick aluminum tread plate for 48” high wainscoting full interior.
Provide 4’-0” LED light fixture(s) as shown on foodservice plans. Must meet health department and 2009 standards with efficacy of no less than 40 lumens per watt.
Matching trim strips and enclosure panels as required to adjacent walls and ceiling.
Provide complete refrigeration system. Provide on-demand defrost on freezer system.

Walk-ins and refrigeration to meet requirements of the Energy Security and Independence Act of 2007 and the Department of Energy’s Walk-in Cooler and Freezer ruling of 2017.

Reference foodservice drawing FS503 for additional details

ITEM # 152.3 EVAPORATOR COIL-FREEZER
Future purchase, coordinate electrical requirements

Reference foodservice drawing FS503 for additional details

ITEM # 152.4 COMPRESSOR-FREEZER
Future purchase, coordinate electrical requirements

Reference foodservice drawing FS5.03 for additional details

ITEM # 178 MOBILE WORK TABLE, 60”x30”
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: T3060SE-BS
Work Table, 60"W x 30"D, 14/300 series stainless steel top, 6" backsplash, square front edge, square turndown ends, 18/300 series stainless steel undershelf, Uni-Lok® gusset system, (4) 1-5/8" O.D. stainless steel legs, NSF
- Square edge table, front and/or rear, per table
- All welded construction, legs, undershelf & top
- Table Casters, 5"Diameter, set of (4), (2) swivel & (2) braked, 250 lb weight capacity per caster, poly cart washable with polymer tread, NSF

ITEM # 202.1 FOOD SHIELD-ADJUSTABLE
Manufacturer: BSI or equal by Premier
Model: ZG9500-4
ZGuard Food Shield, single full-service/vertical partition, fully adjustable, 18" wide tempered glass, 1" diameter aluminum tubing single supports, NSF

Glass thickness to be determined based on glass spans shown in the foodservice bid documents.
Glass thickness shall be minimum 3/8” thick
Finish: verify with architect
1" radius corner, standard

ITEM # 230.1 DOUBLE FRYER BATTERY
Manufacturer: Pitco
Model: 2-SG14-S-/FD

Solstice Supreme™ High Efficiency Prepackaged Fryer System with Solstice™ Solo Filter System, gas, (1) 75 lb. oil capacity full tank, 18"x18" cooking area, solid state controls, boil out, drain valve interlock, melt cycle, stainless steel tank, front & sides, under-fryer drawer filtration, 105,000 BTU (-F), ENERGY STAR®, CSA Flame, CSA Star, NSF, CE

1 year parts and labor warranty
Natural gas
Millivolt Thermostat, standard
Paperless filter assembly
Fryer tank covers
Casters
Basket, (2) oblong/twin size, 13-1/4" x 6-1/2" x 5-3/4" deep, long handle, regular mesh
When located next to an open flame, provide 18”H side splash -removeable for cleaning

Dormont Blue Hose™ Moveable Gas Connector Hose Assembly, 1-1/4" inside dia., 60" long, covered with stainless steel braid, coated with blue antimicrobial PVC, 1 SnapFast® QD, 2 Swivel MAX®, coiled restraining cable with hardware, 441,000 BTU/hr minimum flow capacity, limited lifetime warranty

ITEM # 338 WATER FILTRATION SYSTEM
Manufacturer: 3M or equal by Everpure or OptiPure
Model: SGLP100-CL-BP

(5636204) 3M™ Reverse Osmosis Water Filtration System, with bypass, produces consistent Recipe Quality Water™, minimum 60 psi/maximum 125 psi, minimum 40°/maximum 100°, 100 gpd, sediment, chloramines, chlorine taste and odor, scale reduction, hardness, TDS reduction, includes: (1) RO storage tank, (1) integrated pump, (1) steel bracket, cleaning bypass, wall-mounted, quick disconnect plumbing, 1/2" plumbing connection for optional port (for combi-ovens, single ovens and boilerless steamers)

Verify if an additional storage tank is required

ITEM # 399 TEA BREWER
Manufacturer: Bunn or equal by Curtis, FETCO
Model: 41400.0000

Infusion Series® Iced Tea Brewer, 3 or 5 gallon capacity single brewer (brews 16.3 to 26.7 gallon/hr), 29" trunk, 3 recipe buttons, digital temperature control, brew counter, pulse interface, energy-saver mode, English & Spanish alphanumeric & advertising display, includes single button graphic overlay & Quickbrew & SplashGard® funnel, brews into BUNN tea dispensers, cord attached, UL, NSF

TDO-4 Iced Tea/Coffee Dispenser, cylinder style, 4 gallon capacity (15.1 litres), sump dispense valve, oval shape brew-through plastic lid, faucet handles are labeled sweetened & unsweetened, side handles, NSF
Drip Tray Kit, TCD/TDO

EQHP-TEA Easy Clear® Water Softening Filter, high performance, 4,350 grains of hardness reduction, reduced scale forming minerals, 1 gpm flow rate, 5 micron, integrated carbon block, quick connect, includes: head assembly, integral mounting bracket & single cartridge filter

ITEM # 520 SOILED DISHTABLE
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: SDTX-72-14/3

Spec-Master® Soiled Dishtable, straight design, 72"W x 30"D x 43-1/2"H, operation per plan, 14/304 stainless steel top, 8"H backsplash, 20" x 20" x 5" Deep pre-rinse sink with basket drain, (1) set of 8” o.c. splash mount faucet holes for pre-rinse, raised rolled edges on front & side, stainless steel legs & side bracing, adjustable feet, NSF

All welded construction
Provide 1” turndown at backsplash
Secure the worktable to the wall using stainless steel “Z” clips

ITEM # 527 HOT/COLD FOOD WELL, DROP-IN, ONE PAN
Manufacturer: Vollrath
Model: 3667101D

Hot/Cold Well, Drop-In, top mount, (1) pan, remote mountable panel with on-off switch, hot/cold toggle with indicator lights for hot or cold, thermostatic temperature rotary knob control in hot mode, preset cold control, automatic drain standard, 300 series stainless well & flange, galvanized wrapper, 625 watts, cULus, NSF, NSF7, Made in USA

The KEC is to coordinate with the millwork contractor/fabricator to ensure that the counter design meets the manufacturers ventilation requirements.

ITEM # 533 CLEAN DISHTABLE
Manufacturer: Eagle Group or equal by Advance Tabco, Aero, Atlanta Custom Fab, Universal Stainless, IEI, John Boos, or Nationwide
Model: CDTL-60-14/3

Spec-Master® Clean Dishtable, straight design, 60"W x 30"D x 43-1/2"H, right-to-left operation, 14/304 stainless steel top, 8"H backsplash, raised rolled edges on front & side, stainless steel legs & crossbracing, adjustable metal feet, NSF

Provide 1” turndown at backsplash
Secure the worktable to the wall using stainless steel “Z” clips

END OF PHASE 2 SPECIFICATION

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SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manually operated roller shades with single rollers.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
   2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Verification: For each type of roller shade.
   1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
   2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
   3. Installation Accessories: Full-size unit, not less than 10 inches long.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product indicated on the Finish Schedule, Mecho/5x by MechoShade Systems, Inc., or comparable products by one of the following:
   1. Draper Inc.
   2. Hunter Douglas Contract.
   3. Lutron Electronics Co., Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS (RS1)

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Stainless steel.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Chain tensioner, jamb mounted.
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Roller Drive-End Location: Right side of inside face of shade.
   2. Direction of Shadeband Roll: Regular, from back of roller.
   3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Shadebands:
   1. Shadeband Material: Light-filtering fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.
      b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:
   1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
      a. Shape: L-shaped.
      b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
      c. Finish Color: Quaker bronze.
   2. Endcap Covers: To cover exposed endcaps.
   3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
      a. Closure-Panel Width: As indicated on Drawings.
   4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
   5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
   6. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
   1. Source: Roller-shade manufacturer.
   2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
   3. Weave: Mesh.
   4. Roll Width: As indicated on Drawings.
   5. Openness Factor: 1 percent.
   6. Color: As selected by Architect from manufacturer's full range, Howard 1122.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
   1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
   2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

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

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 12 36 16 - METAL COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stainless-steel countertops and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal countertops only after casework has been completed in installation areas.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction to receive metal countertops by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

B. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 07 92 00 "Joint Sealants."
   1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, acid curing, silicone.
   2. Color: As selected by Architect from manufacturer's full range.

2.2 **STAINLESS-STEEL** COUNTERTOPSAND SINKS

A. Countertops: Fabricate from 0.062-inch-thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch over the base cabinets.
   1. Joints: Fabricate countertops without field-made joints.
   2. Weld shop-made joints.
   3. Sound deaden the undersurface with heavy-build mastic coating.
   4. Extend the top down to provide a 1-inch-thick edge with a 1/2-inch return flange.
   5. Form the backsplash and endsplash coved to and integral with top surface, with a ½-inch-thick top edge and 1/2-inch return flange.
      a. Provide endsplash at all locations where countertop is butted up against a side wall. Open countertop ends are to have endsplashes only when detailed on Drawings.

6. Provide raised (marine) edge around perimeter of tops containing sinks; pitch tops containing sinks two ways to provide drainage without channeling or grooving.
7. Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit.
8. Legs.

B. Stainless-Steel Sinks: Fabricate from stainless-steel sheet, not less than 0.050-inch nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch radius. Slope the sink bottoms to outlet without channeling or grooving. Provide continuous butt-welded joints.
1. Provide sizes indicated or manufacturer's closest standard size of equal or greater volume, as approved by Architect.
2. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch diameter.
3. Factory punch holes for fittings.
4. Provide sinks with stainless-steel strainers and tailpieces.
5. Provide sinks with integral rims except where located in stainless-steel countertops.
6. Apply 1/8-inch-thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.

2.3 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of metal countertops.

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

3.2 INSTALLATION

A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.

B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

C. Secure tops to cabinets with Z- or L-type fasteners or equivalent; use two or more fasteners at each front, end, and back.

D. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

E. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over the countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

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SECTION 12 36 61 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quartz agglomerate countertops and splashes.

B. Related Sections:
   1. Division 22 for non-integral sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and splash profiles, methods of joining, seam locations and cutouts (specific size, as specified by manufacturer) for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products. Samples are not required if Basis-of-Design Product is submitted.
   1. Countertop material, 6 inches square.
   2. One full-size solid-surface-material countertop, with front edge and splash, 8 by 10 inches, of construction and in configuration specified.
   3. One full-size quartz agglomerate countertop, with front edge and splash, 8 by 10 inches, of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or splashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOPS (SSM1, SSM2)

A. Configuration: Provide countertops with the following front and backsplash style, unless otherwise indicated.
   1. Front: Straight, slightly eased at top.
   2. Backsplash: Straight, slightly eased at corner.
   3. Endsplash: Matching backsplash.

B. Countertops: 2 cm (0.787-inch)-thick quartz agglomerate with front edge built up with same material, unless otherwise indicated.
   1. At breakroom, or other locations with sinks, provide ¾” thick plywood substrate and brackets as necessary.
   2. Build up front edge to thickness indicated. Seam to be on vertical surface.

C. Splashes: 2 cm (0.787-inch)-thick quartz agglomerate, unless otherwise indicated.
   1. Provide endsplash at all locations where countertop is butted up against a side wall.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Make cutouts for fixtures in the shop using templates furnished by fixture manufacturer.
      a. For undercounter fixtures, fabricate vertical cut edges straight, slightly eased at top.
      b. Interior corners to have a minimum radius of ¼”. Square corners will not be allowed.
      c. Cutouts to be a minimum of 2” apart.
      d. Install support for the cutouts within 2” of all edges of the cutout.
   2. Drill holes for plumbing fittings and soap dispensers in the shop.
   3. Provide clearances between quartz countertop and adjacent walls, appliances or cabinetry as recommended by countertop manufacturer.
   4. Provide supports for all surface seams according to manufacturer. Avoid placing seams within 3 inches of a cut out or inside corners.

2.2 COUNTERTOP MATERIALS

A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

B. Adhesives: Adhesives shall not contain added urea formaldehyde.

C. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Finish Legend by Cambria, or comparable product by one of the following:
      a. Cosentino USA.
      b. E. I. du Pont de Nemours and Company.
      c. Wilsonart International.
      d. Caeserstone International.
   2. Colors and Patterns: As indicated by manufacturer's designations, refer to Finish Schedule.

D. Countertop Brackets: 1/8” thick metal wall brackets to be painted to match adjacent wall unless noted otherwise on Drawings or Finish Schedule.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Rakks, EH 1824.
         1) Counters up to 25” deep to have 24” side mounted against wall.
         2) Counters between 25 ½” and 30” to have 18” side mounted against wall.
      b. Gambas, Workstation Brackets, 18” x 24” with cleat mount.
   2. Spacing: 36” o.c. between brackets with first bracket placed 18” from side wall or cabinet.

E. Cleats: continuously painted wood or aluminum angle.
   1. Basis of Design: Rakks: 2” x 2” x 1/8” Cleat Stock.

2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops:2-inchOD,black, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Product: Subject to compliance with requirements, provide " SG series" by Doug Mockett & Company, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Secure countertops to subtops with silicone adhesive according to solid surface material manufacturer's written instructions. Apply adhesive in large dots approximately 15 inches apart; do not fully spread adhesive across subtop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten countertops by screwing through corner blocks of base units or brackets into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   2. Seal edges of cutouts in subtops by saturating with varnish.

D. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION

SECTION 12 48 13 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient entrance mats.
   2. Surface-mounted frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:
   1. Divisions between mat sections.
   2. Perimeter floor moldings.

C. Samples: For the following products, in manufacturer's standard sizes:
   1. Floor Mat: Assembled sections of floor mat.
   2. Tread Rail: Sample of each type and color.
   3. Frame Members: Sample of each type and color.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
   1. Uniform floor load of 300 lbf/sq. ft..
   2. Wheel load of 350 lb per wheel.

B. Regulatory Requirements: Comply with applicable provisions in The Department of Justice 2010 ADA Standards, and IBC and ICC/ANSI A117.1 or other locally enforced accessibility standards.

2.2 RESILIENT ENTRANCE MATS (EM1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide C/S Group, Pedimat M1 Surface-Mounted; as indicated on Finish Schedule, or a comparable product by one of the following:
   1. American Floor Products Company, Inc.
   2. American Mat & Rubber Company.
   3. Arden Architectural Specialties, Inc.
   4. Balco, Inc.
   5. Cactus Mat Mfg. Co.
   6. Consolidated Plastics Company, Inc.
   7. Durable Corporation.
   8. Flexco.
   9. Mats Inc.
   10. Musson Rubber Company.
   11. Pawling Corporation; Architectural Products Division.
   12. Sbemco International Inc.; Matting by Design.
   13. Tennessee Mat Company, Inc.
   14. Tepromark International, Inc.
   15. U.S. Mat & Rubber Corporation.

B. Carpet-Type Mats: Nylon carpet bonded to 1/8- to 1/4-inch-thick, flexible vinyl backing to form mats 7/16 inch thick with nonraveling edges.
   1. Colors, Textures, and Patterns: As selected by Architect from full range of industry colors.
   2. Mat Size: As indicated.

2.3 FRAMES

A. Surface-Mounted Frames:
   1. Tapered Frames: Tapered aluminum frame members, not less than 1-1/2 inches wide, attached to mat at all four edges, with welded mitered corners.
      a. Aluminum Color: Clear Black, as indicated on Finish Schedule.

2.4 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Surface-Mounted Frames: As indicated for permanent surface-mounted installation, complete with corner connectors, splice plates or connecting pins, and postinstalled expansion anchors.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.5 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.

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

3.2 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

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SECTION 13 34 19 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Metal soffit panels.
5. Thermal insulation.
6. Doors and frames.
7. Clerestory windows.
8. Accessories.

B. Related Sections:
1. Section 07 21 11 “Pre-Engineered Building Insulation”
2. Section 08 11 13 "Hollow Metal Doors and Frames."
3. Section 08 36 13 "Sectional Doors."
4. Section 08 51 13 "Aluminum Windows."

1.2 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
1. Structural-steel-framing system.
2. Metal roof panels.
3. Metal wall panels.
4. Insulation and vapor retarder facings.
5. Flashing and trim.
6. Doors.
7. Clerestory windows.
8. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.
1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
a. Show provisions for attaching roof curbs, platforms and pipe racks.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
    a. Show roof-mounted items including equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
    b. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    a. Flashing and trim.
    b. Gutters.
    c. Downspouts.
    d. Roof ventilators.
    e. Louvers.

C. Samples for Initial Selection: For units with factory-applied color finish.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:
1. Metal Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
3. Vapor-Retarder Facings: Nominal 6-inch-square Samples.
4. Accessories: Nominal 12-inch-long Samples for each type of accessory.

E. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.

F. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation registered in the State of Oklahoma.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified erector, manufacturer and professional engineer.

B. Manufacturer Accreditation: Statement that metal building system and components were designed and produced by a manufacturer accredited according to the International Accreditation Service's AC472.

C. Welding certificates.

D. Metal Building System Certificates: For each type of metal building system, from manufacturer.
1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
    a. Name and location of Project.
    b. Order number.
    c. Name of manufacturer.
    d. Name of Contractor.
    e. Building dimensions including width, length, height, and roof slope.
    f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
    g. Governing building code and year of edition.
    h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, temperature loads during service and construction of the building, and auxiliary loads (cranes and rigging loads).

i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
j. Building-Use Category: Indicate category of building use and its effect on load importance factors.

E. Erector Certificates: For each product, from manufacturer.

F. Manufacturer Certificates: For each product, from manufacturer.

G. Material Test Reports: For each of the following products:
1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

I. Source quality-control reports.

J. Field quality-control reports.

K. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

L. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
1. Accreditation: According to the International Accreditation Service's AC472.
2. Engineering Responsibility: Preparation of a 3-dimensional or justifiable 2-dimensional comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

D. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

G. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

H. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
   2. Combustion Characteristics: ASTM E 136.

I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Build mockups for typical wall metal panel including accessories.
      a. Size: 48 inches long by 48 inches.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

J. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to metal building systems including, but not limited to, the following:
      a. Condition of foundations and other preparatory work performed by other trades.
      b. Structural load limitations.
      c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
      d. Required tests, inspections, and certifications.
      e. Unfavorable weather and forecasted weather conditions.
   2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
      a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
      b. Structural limitations of purlins and rafters during and after roofing.
      c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
      d. Temporary protection requirements for metal roof panel assembly during and after installation.
      e. Roof observation and repair after metal roof panel installation.
   3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
      a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
      b. Structural limitations of girts and columns during and after wall panel installation.
      c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
      d. Temporary protection requirements for metal wall panel assembly during and after installation.
      e. Wall observation and repair after metal wall panel installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:
   1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
   2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Coordinate installation of roof curbs, equipment supports and roof penetrations, which are specified in Section 07 72 00 "Roof Accessories."

C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Alliance Steel, Inc.
   2. American Steel Building Co., Inc.
   3. Behlen Mfg. Co.
   4. Butler Manufacturing Company; a BlueScope Steel company.
   5. Ceco Building Systems; Division of NCI Building Systems, L.P.
   6. Inland Buildings; Subsidiary of Behlen Mfg. Co.
   7. Mesco Building Solutions; Division of NCI Building Systems, L.P.
   8. Metallic Building Company; Division of NCI Building Systems, L.P.
   9. Nucor Building Systems.
   10. Star Building Systems; an NCI company.
   11. VP Buildings; a United Dominion company.

2.2 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
   1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.

B. Primary-Frame Type:
   1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.

E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.

F. Bay Spacing: As indicated on drawings.

G. Roof Slope: 3 inches per 12 inches.

H. Roof System: Manufacturer's standard vertical-rib, standing-seam metal roof panels with field-installed insulation.

I. Exterior Wall System: Manufacturer's standard tapered-rib, exposed-fastener metal wall panels with field-installed insulation.

2.3 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. Engineer must be licensed in the State of Oklahoma.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
   1. Design Loads: As indicated on Structural Drawings.

2. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
   a. Girder supporting gravity snow or live loads: Deflection of 1/360 of the span.
   b. Girts:
      1) Grits and purlins supporting snow or live loads: Deflection of 1/240 of the span.
      2) Grits not supporting CMU veneer: Horizontal deflection of 1/360 of the span.
      3) Grits supporting CMU veneer: Horizontal deflection of 1/600 of the span.
   c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
   d. Metal Wall Panels: Horizontal deflection of 1/240 of the span.
   e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:
   a. Lateral Frame Drift: Maximum of H/240.
   b. Seismic Drift: Refer to Structural Drawings.
4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects during service and construction. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of Insert value.

F. Air Infiltration for Metal Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 1.57 lbf/sq. ft..

G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft..

H. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft..

I. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

J. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:
   1. Metal Roof Panel Assemblies:
      a. U-Factor: 0.033.
      b. R-Value: R19 plus R11 liner system.
   2. Metal Wall Panel Assemblies:
      a. U-Factor: 0.053.
      b. R-Value: R19.

K. Energy Performance: Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for steep-slope roof products.

2.4 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
   1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
      a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
   2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
   3. Frame Configuration: Single gable.
   4. Exterior Column Type: Tapered where allowed by drawings.
   5. Rafter Type: Tapered.

B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
   1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
   2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
   1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.
      a. Depth: As needed to comply with system performance requirements.
      b. Provide zinc-coated (galvanized) steel purlins at all locations.
   2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.
      a. Depth: As required to comply with system performance requirements.
      b. Provide zinc-coated (galvanized) steel girts at all locations.
   3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
      a. Provide zinc-coated (galvanized) steel struts at all locations.
   4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
      a. Provide zinc-coated (galvanized) steel bracing at all locations.
   5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
      a. Provide zinc-coated (galvanized) steel bracing at all locations.
   6. Base or Sill Angles: Minimum 3-by-2-inch zinc-coated (galvanized) steel sheet.
   7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
   8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from zinc-coated (galvanized) steel sheet at all locations where primary steel framing is galvanized; and structural-steel sheet at Maintenance Building.
   9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
   10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet as applicable; designed to withstand required loads.

D. Perpendicular Lateral Frames: Provide adjustable wind bracing as follows:
   1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
   2. Cable: ASTM A 475, 1/4-inch-diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
   3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
   4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
   5. Bracing: Provide lateral bracing using any method specified above, at manufacturer's option.

E. Bolts: Provide plain-finish bolts for structural-framing components that are primed or field painted (at Maintenance Building and elsewhere if indicated). At all other locations, provide zinc-plated bolts for structural-framing components that are galvanized.
   1. All base plate bolts, including plain-finish bolts and zinc-plated bolts, shall be coated with galvanizing paint after erection of structural framing.

F. Materials:
   1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
   2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
   3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
   4. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70.
   5. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.
   6. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
      a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
   7. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
      a. Finish: Plain at Maintenance Building; mechanically deposited zinc coating, ASTM B 695, Class 50 at all other locations.
   8. High-Strength Bolts, Nuts, and Washers: ASTM 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.
      a. Finish: Plain at Maintenance Building; mechanically deposited zinc coating, ASTM B 695, Class 50 at all other locations.
   9. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
      a. Finish: Plain at Maintenance Building; mechanically deposited zinc coating, ASTM B 695, Class 50 at all other locations.
   10. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
      a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

11. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
    a. Configuration: Straight.
    b. Nuts: ASTM A 563 heavy-hex carbon steel.
    c. Plate Washers: ASTM A 36/A 36M carbon steel.
    d. Washers: ASTM F 436 hardened carbon steel.
    e. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
12. Headed Anchor Rods: ASTM F 1554, Grade 36.
    a. Configuration: Straight.
    b. Nuts: ASTM A 563 heavy-hex carbon steel.
    c. Plate Washers: ASTM A 36/A 36M carbon steel.
    d. Washers: ASTM F 436 hardened carbon steel.
    e. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
13. Threaded Rods: ASTM A 193/A 193M.
    a. Nuts: ASTM A 563 heavy-hex carbon steel.
    b. Washers: ASTM F 436 hardened carbon steel.
    c. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
    a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side unless noted otherwise.
2. Prime galvanized members with specified primer after phosphoric acid pretreatment.
    a. Primary steel framing shall be hot-dip galvanized.
    b. Secondary steel framing shall be either hot-dip galvanized or made from pre-galvanized sheets.
    c. Anchor bolts shall be painted with a galvanizing paint in the field after installation.
3. Primer: SSPC-Paint 15, Type I, red-oxide color.
4. (Base Bid) Apply Macropoxy 646 Fast Cure Epoxy by Sherwin Williams or an approved equivalent epoxy shall be applied to areas noted on drawings that shall be protected from an uncontrolled/exterior environment with a minimum of 2 coats of 5mils each.
    a. Surface preparation: SSPC-3, water-based degreasers as needed for compliance with the warranty, red-oxide color.
5. (Alternate Bid) All exposed steel that is not pre-galvanized shall be hot-dipped galvanized in lieu of high-performance coating as noted in Base Bid above. Refer to Section 01 23 00 “Alternates” and Section 09 91 13 “Exterior Painting.”
6. Base and Alternate Bids do not include Maintenance Building steel framing, which is not required to be galvanized or coated with epoxy coating.

2.5 METAL ROOF PANELS

A. Vertical-Rib, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.
    a. Exterior Finish: Fluoropolymer.
    b. Color: As selected by Architect from manufacturer's full range.
2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
3. Joint Type: Mechanically seamed, double folded.
4. Panel Coverage: 16 inches.
5. Panel Height: 3 inches.
6. Uplift Rating: UL 90.

B. Materials:
1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
b. Surface: Smooth, flat finish.

C. Finishes:
1. Exposed Coil-Coated Finish:
a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 METAL WALL PANELS

A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.
a. Exterior Finish: Fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.
2. Major-Rib Spacing: 12 inches o.c.
3. Panel Coverage: 36 inches.
4. Panel Height: 1.25 inches to 1.5 inches.

B. Tapered-Rib-Profile, Metal Liner Panels (At Main Arena): Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.
a. Exterior Finish: Siliconized polyester.
b. Color: As selected by Architect from manufacturer's full range.
2. Major-Rib Spacing: 12 inches o.c.
3. Panel Coverage: 36 inches.
4. Panel Height: 1.25 inches to 1.5 inches.

C. Flush-Profile, Metal Liner Panels (At Expo Hall): Solid panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels; designed for interior side of metal wall panel assemblies and installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.
1. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.
a. Exterior Finish: Siliconized polyester.
b. Color: As selected by Architect from manufacturer's full range.
2. Sound Absorption: NRC not less than 0.85 when tested according to ASTM C 423.
3. Panel Coverage: 12 inches.
4. Panel Height: 1.5 inches.

D. Materials:
1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
b. Surface: Smooth, flat finish.

E. Finishes:
1. Exposed Coil-Coated Finish:
a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.7 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges; with flush joint between panels; with 1-inch-wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.
1. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.
a. Exterior Finish: Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. Color: As selected by Architect from manufacturer's full range.
2. Panel Coverage: 16 inches.
3. Panel Height: 1 inch.

2.8 THERMAL INSULATION

A. Refer to Section 07 21 11 “Pre-Engineered Building Insulation” for roof insulation assembly consisting of fiberglass batts, vapor barrier liner, thermal breaks, straps and other proprietary components.

B. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm when tested according to ASTM E 96/E 96M, Desiccant Method.
a. Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.

C. Retainer Strips: 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.9 DOORS AND FRAMES

A. Swinging Personnel Doors and Frames: As specified in Section 08 11 13 "Hollow Metal Doors and Frames."

2.10 CLERESTORY WINDOWS

A. Aluminum Windows: As specified in Section 08 51 13 "Aluminum Windows."

B. Glazing: Comply with requirements specified in Section 08 80 00 "Glazing."

2.11 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
   2. Clips: Manufacturer's standard, formed from stainless-steel sheet, designed to withstand negative-load requirements.
   3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from stainless-steel sheet or nylon-coated aluminum sheet.
   4. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
   1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
   2. Opening Trim: Formed from 0.034-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
   1. Gutter Supports: Fabricated from same material and finish as gutters.
   2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Formed from 0.022-inch nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
   1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
   1. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; fabricated from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot-long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
      a. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire; or aluminum, 1/2-inch-square mesh, 0.063-inch wire.
      b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches of floor.
      c. Throat Size: 9 or 12 inches, as standard with manufacturer, and as required to comply with ventilation requirements.

H. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet; finished to match metal wall panels. Form blades from 0.040-inch nominal-thickness, metallic-coated steel sheet; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.
   1. Blades: Fixed.
   2. Free Area: Not less than 7.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
   3. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
      a. Mounting: Interior face of louvers.
   4. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches o.c., whichever is less.

I. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

J. Materials:
   1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
      a. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
      b. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
      c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
      d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:
    a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
    b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.12 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate product.

B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
1. Special inspections will not be required if fabrication is performed by manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
    a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

C. Testing: Test and inspect shop connections for metal buildings according to the following:
1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector'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. Product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

2.13 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.
1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
   1. Make shop connections by welding or by using high-strength bolts.
   2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
   3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
   4. Weld clips to frames for attaching secondary framing.
   5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
   1. Make shop connections by welding or by using non-high-strength bolts.
   2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
   1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
   1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. 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 will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
   1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
      a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
   1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
   2. Locate and space wall girts to suit openings such as doors and windows.
   3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
   1. Tighten rod and cable bracing to avoid sag.
   2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

K. Finish: All areas of finish on framing members that was left blocked out, unfinished, or scratched shall be finished and touched up in the field with the appropriate primer/epoxy as directed by drawings and this specification.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
   1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
      a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
   2. Install metal panels perpendicular to structural supports unless otherwise indicated.
   3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
   6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
   1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
   1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
   1. Install ridge and hip caps as metal roof panel work proceeds.
   2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-drilling or self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
   4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
   5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.

6. Provide metal closures at peaks, rake edges, rake walls and each side of ridge and hip caps.

C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
   1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
   2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
   3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:
   1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
   2. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
      a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
   3. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
   1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
   2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

3.9 DOOR AND FRAME INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
   1. Between Doors and Frames at Jambs and Head: 1/8 inch.
   2. Between Edges of Pairs of Doors: 1/8 inch.
   3. At Door Sills with Threshold: 3/8 inch.
   4. At Door Sills without Threshold: 3/4 inch.
   5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.

3.10 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Tie downspouts to underground drainage system indicated.

E. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.

F. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
   1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
   2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
   3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
   4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

G. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.11 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Inspection of fabricators.
   2. Steel construction.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Tests and Inspections:
   1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector'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. Product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

C. Windows: Adjust screens and accessories for a tight fit at contact points and at weather stripping to ensure weathertight closure.

D. Roof Ventilators: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily and be free of warp, twist, or distortion as needed to provide fully functioning units.

3.13 CLEANING 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. Repair damaged epoxy and/or primer coatings on structural items with the appropriate repair paint according to ASTM A 780 and manufacturer's written instructions.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
   1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

E. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting", Section 09 96 00 “High Performance Coatings” and Section 09 91 23 "Interior Painting."

F. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
   1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

G. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
   1. Immediately before final inspection, remove protective wrappings from doors and frames.

H. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

I. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
   1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
      a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

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SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

A. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

B. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers; 2007.

F. ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded; The American Society of Mechanical Engineers; 2009.

G. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2009).

H. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

I. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2008.

J. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.

K. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2010.

L. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

M. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

N. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
   1. Shop drawing submittals shall be individually submitted by specification section number in PDF format. Combined submittals will be returned for contractor to divide.
   2. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, approved by manufacturer.

C. Welders certification: In accordance with ASME (BPV IX).

D. Conform to UL, FM, requirements.

E. Valves: Bear UL, FM, label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13 International Fire Code, International Building Code and specifications.

B. Welding Materials and Procedures: Conform to ASME Code.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A 795 Schedule 10, or ASTM A 53 Schedule 40, black or galvanized. Allied Dyna-Thread and Dyna-Flow or similar piping may be used in lieu of Schedule 40 and Schedule 10. All threadable pipe shall have a Corrosion Resistance Ratio (CRR) of 1.00 at threads. Allied BLT, XL or similar type pipe is prohibited.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
   4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1 to 4 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 6 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel Unistrut channels or equal with clamps and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.4 GATE VALVES

A. Up to and including 2 inches:
   1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
   1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

C. Over 4 inches:
   1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.5 GLOBE OR ANGLE VALVES

A. Up to and including 2 inches:
   1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:
   1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.6 BALL VALVES

A. Up to and including 2 inches:
   1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

B. Over 2 inches:
   1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.7 BUTTERFLY VALVES

A. Bronze Body:
   1. Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amps at 115 volt AC.

B. Cast or Ductile Iron Body:
   1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device , and internal tamper switch rated 10 amp at 115 volt AC.

2.8 CHECK VALVES

A. Up to and including 2 inches:
   1. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches:
   1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

C. 4 inches and Over:
   1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.9 DOUBLE CHECK VALVES (BACKFLOW PREVENTOR)

A. 2 1/2” inches and over:
   1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check. ASSE 1015.

2.10 DRAIN VALVES

A. Ball Valve:
   1. Brass with cap and chain, 3/4 inch hose thread.

2.11 SUPERVISORY/TAMPER SWITCHES

A. For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Sleeve pipes passing through partitions, walls, and floors.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

N. Provide gate or ball valves for shut-off or isolating service.

O. Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.3 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

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SECTION 21 05 53 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; the American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Major Control Components: Nameplates.

B. Piping: Tags or Pipe markers.

C. Pumps: Nameplates.

D. Relays: Tags.

E. Small-sized Equipment: Tags.

F. Valves: Tags or Nameplates

2.2 MANUFACTURERS

A. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

B. Seton Identification Products: www.seton.com.

C. Brady Corporation: www.bradycorp.com.

D. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.4 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.5 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Identify valves in main and branch piping with tags.

F. Identify pumps with plastic nameplates. Small devices, such as in-line pumps may be identified with tags.

G. Identify piping, concealed or exposed with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 21 13 00 - FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.2 RELATED REQUIREMENTS

A. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

B. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

D. Section 26 27 02 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene two weeks before starting work of this section.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
   1. Submit working plans indicating sprinkler head locations coordinated with ceiling installation, pipe routing, fire department connections and riser locations.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
   3. Submit shop drawings to authority having jurisdiction for approval. Submit proof of approval to Engineer.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

1.6 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL FM requirements.

C. Designer Qualifications: Design system under direct supervision of a NICET Level III, experienced in design of this type of work.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience approved by manufacturer.

F. Equipment and Components: Provide products that bear UL and FM label or marking.

G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
1. Tyco Fire Suppression & Building Products: www.tyco-fire.com.
2. Viking Corporation: www.vikinggroupinc.com.
3. Reliable Automatic Sprinkler Co.: www.reliable-sprinkler.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 SPRINKLER SYSTEM

A. Sprinkler System: Fire protection contractor shall provide design build services based on the requirements herein specified. System shall provide coverage for entire building or building areas noted. Provide dry pipe assembly system for Stall Barn under alternate #1.

B. System Piping Location: Wet system piping shall be installed at highest elevation possible. Piping shall be installed above all mechanical equipment, ductwork, and all plumbing system piping. Fire protection contractor shall coordinate fire protection piping prior to installation.

C. Occupancy: Shall comply with NFPA 13. See plans for occupancy areas.

D. Water Supply: Current water supply is provided by Canadian County, Oklahoma, Rural Water District. The City of El Reno, Oklahoma is proposing to annex this site and would be providing the water supply.
   1. City of El Reno proposed calculated water data for this site.
      a. Static pressure: 84 PSI
      b. Residual pressure: 40 PSI.
      c. Calculated Flow: 2000 GPM.
   2. Contractor shall coordinate with the facility who becomes responsible for supplying water to this site to determine volume and pressure from water flow test data.
   3. Current water data for this site:
      a. Static pressure: 60 PSI.
      b. Residual pressure: 10 PSI.
      c. Measured flow: 530 GPM.
      d. Current flow and pressure not sufficient for this building and would require water storage tank and pumps.

E. Interface system with building control system and fire alarm system.

F. Provide remote and wall mounted fire department connections and bell as required.

G. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire riser.

2.3 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Enamel, color white
   4. Escutcheon Plate Finish: Enamel, color white.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Standard upright type. Provide head guards in areas where sprinkler heads are subject to damage.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass. Chrome plated.
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Chrome plated.
   4. Escutcheon Plate Finish: Chrome plated.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
   6. Substitutions: Refer to Section 01 60 00 - Product Requirements.

D. Dry Sprinklers: pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Chrome plated.
   4. Escutcheon Plate Finish: Chrome plated.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

E. Guards: Finish to match sprinkler finish.

2.4 PIPING SPECIALTIES

A. Provide proper backflow protection to fire protection system as required per Authority Having Jurisdiction.

B. Flexible Sprinkler Drop Fittings: Corrugated Type 304 stainless steel hose with braided Type 304 stainless steel exterior cover, welded stainless steel or zinc plated steel inlet and outlet threaded fittings with EPDM seals. 175 PSI pressure rating. 225 ˚F temperature rating, 1" minimum internal hose diameter. 60" maximum hose length, straight or angle outlet configuration. Galvanized steel ceiling support bar and brackets selected to match project ceiling support system requirements. UL Listed and FM approved.

C. Electric Alarm: Electrically operated red enameled horn and strobe.

D. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 120 volt AC and 2.5 amp at 24 volt DC.

E. Fire Department Connections: Coordinate exact FDC type and location with AHJ or Local Fire Marshall:
   1. Type: Flush mounted remote wall type with brass finish.
   2. Outlets: Verify FDC outlet type with local Fire Department.
   3. Drain: 3/4 inch automatic drip, outside.
   4. Label: "Sprinkler - Fire Department Connection".

F. Supervisory and Tamper Switches: For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

G. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities
   1. Activate electric alarm.
   2. Test and drain valve.
   3. Externally resettable.
   4. Replaceable internal components without removing valve from installed position.

H. Dry Pipe Valve assembly with air compressor. Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.
   1. Dry Pipe Valves: Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for air supply, drain, priming level, alarm connections, pressure gages, priming chamber attachment, ball drip valves, drip cup assembly piped to floor or hub drain, fill line attachment with strainer.
   2. Air Compressor: Single zone and small systems: Riser pipe mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor. With check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking model E-1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Install buried shut-off valves in valve box. Provide post indicator.

D. Provide approved double check valve, ASSE 1015 listed assembly at sprinkler system water source connection.

E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

F. Locate outside alarm horn and strobe on building wall as indicated.

G. Place pipe runs to minimize obstruction to other work.

H. Place piping in concealed spaces above finished ceilings.

I. Center sprinklers in one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements and provide piping offsets as required.

J. Flexible sprinkler drop fittings: Install in accordance with manufacturer's installation instructions following minimum bend radii, maximum number of bends and bend distance from end requirements.

K. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

L. Hose Outlet Valves: Install at each standpipe outlet and elsewhere where indicated approximately 4 feet above floor.

M. Fire Department and Fire Pump Test Connections: Mount on wall where indicated. Support from structure independent of piping. Locate between 2' to 3' above grade. Fill wall penetration with insulation and caulk exterior and interior face of wall opening weather tight.

N. Flush entire piping system of foreign matter.

O. Install guards on sprinklers where indicated.

P. Hydrostatically test entire system.

Q. Require test be witnessed by Fire Marshal and authority having jurisdiction.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system and building controls system.

3.3 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

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SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SCOPE

A. This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Reference.
      c. Standards.
      d. Quality Assurance.
      e. Sleeves and Openings.
      f. Sealing and Firestopping.
      g. Equipment Furnished By Others.
      h. Provisions for Future.
      i. Off Site Storage.
      j. Codes.
      k. Certificates and Inspections.
      l. Submittals.
      m. Operating and Maintenance Data.
      n. Training of Owner Personnel.
      o. Record Drawings.
   2. PART 2 – PRODUCTS.
      a. Access Panels and Doors.
      b. Sealing and Firestopping.
   3. PART 3 – EXECUTION.
      a. Excavation and Backfill.
      b. Sheeting, Shoring and Bracing.
      c. Dewatering.
      d. Rock Excavation.
      e. Concrete Work.
      f. Cutting and Patching.
      g. Building Access.
      h. Equipment Access.
      i. Coordination.
      j. Lubrication.
      k. Sleeves.
      l. Sealing and Firestopping.

1.2 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 22 sections of plumbing.

1.3 STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ACPA American Concrete Pipe Association.
   2. AGA American Gas Association.
   3. ANSI American National Standards Institute.

4.	ASME	American Society of Mechanical Engineers.
5.	ASPE	American society of Plumbing Engineers.
6.	ASSE	American Society of Sanitary Engineering.
7.	ASTM	American Society for Testing and Materials.
8.	AWWA	American Water Works Association.
9.	AWS	American Welding Society.
10.	CISPI	Cast Iron Soil Pipe Institute.
11.	CGA	Compressed Gas Association.
12.	CS	
13.	EPA	Environmental Protection Agency.
14.	IAPMO	International Association of Plumbing & Mechanical Officials.
15.	MCA	Mechanical Contractors Association.
16.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
17.	NBS	National Bureau of Standards.
18.	NEC	National Electric Code.
19.	NFPA	National Fire Protection Association.
20.	NSF	National Sanitation Foundation.
21.	PDI	Plumbing and Drainage Institute.
22.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
23.	STI	Steel Tank Institute.
24.	UL	Underwriters Laboratories Inc.

B. Standards referenced in this section:

1.	ACI 614	Recommended Practice for Measuring, Mixing and Placing of Concrete.
2.	ASTM D1557	Standard Test Method for Moisture-Density Relations of Soils.
3.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials.
5.	D.O.T.	Standard Specifications for Road and Bridge Construction, State of Oklahoma Dept. of Transportation.
6.	UL1479	Fire Tests of Through-Penetration Firestops.
7.	UL723	Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 40 00 - Quality Requirements.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

1.5 LEAD FREE REQUIREMENTS

A. All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤0.25% per the Federal Safe Drinking Water Act as amended January 4, 2011 Section 1417.

B. This requirement applies to all of the subsequent Plumbing Specification Sections and Plumbing Drawings and supersedes any part or model number that may conflict with this requirement.

1.6 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1, General Requirements for Protection of Finished Surfaces.

1.7 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements.

1.8 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.9 EQUIPMENT FURNISHED BY OTHERS

A. Coordinate with Food Service Equipment supplier for location of kitchen equipment. Contractor shall rough-in and make final connections to equipment furnished by others. See Plumbing plans.

1.10 PROVISIONS FOR FUTURE

A. Coordinate with owner for final location of valves for future building additions. See Plumbing plans.

1.11 OFF SITE STORAGE

A. Prior approval by Owner and the Engineer will be needed. The Contractor shall submit Storage Agreement Form AD-BDC-74 to Owner for consideration of offsite materials storage. Generally, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for offsite storage. No material will be accepted for offsite storage unless shop drawings for the material have been approved.

1.12 CODES

A. Comply with requirements of Oklahoma Code Requirements.

1.13 CERTIFICATES AND INSPECTIONS

A. Refer also to Division 1, General Requirements.

B. Obtain and pay for all required State installation inspections except those provided by the Engineer in accordance with Oklahoma Code Requirements. Deliver originals of these certificates to the Owner's Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

1.14 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Not more than two weeks after award of contract but before any shop drawings are submitted, Contractor to submit the following plumbing system data sheet. List piping material type for each piping service on the project, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves and specialties for each piping service, fixture and equipment with manufacturer and model number. The approved plumbing system data sheet(s) will be made available to the Owner's Project Representative for their use on this project.

PLUMBING SYSTEM DATA SHEET

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Piping			
Meters & Gages			
Valves:			
Identification:			
Hangers & Supports			
Insulation			
Piping Specialties:			
Plumbing Fixtures			
Plumbing Equipment			

C. Shop drawing submittals shall be individually submitted by specification section number in PDF format. Combined submittals will be returned for contractor to divide.

D. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

1. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:
   a. Operating and Maintenance Manuals — 2 copies.
   b. Owner — 2 copies.
   c. Architect/Engineer — 1 copy.
   d. Owner Field Office — 1 copy.

1.15 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 77 00 - Closeout Procedures.

B. In addition to the general content specified under Section 01 77 00 - Closeout Procedures supply the following additional documentation:

1. Records of tests performed to certify compliance with system requirements.
2. Manufacturer's wiring diagrams for electrically powered equipment.
3. Certificates of inspection by regulatory agencies.
4. Valve schedules.
5. Lubrication instructions, including list/frequency of lubrication.
6. Parts lists for fixtures, equipment, valves and specialties.
7. Manufacturer's installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
8. Additional information as indicated in the technical specification sections.

1.16 TRAINING OF OWNER PERSONNEL

A. Instruct Owner's personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than six (6) hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup, operation and shutdown procedures for all equipment. All training to be during normal working hours. Videotape all instructions and provide Owner with copy.

1.17 RECORD DRAWINGS

A. Refer to Division 1, General Requirements.

PART 2 - PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Plaster Walls and Ceilings:
   1. 18 gauge frame with not less than a 16 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12".

2.2 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:
   1. Manufacturers:
      a. 3M: www.3m.com.
      b. Hilti: www.hilti.com.
      c. Rectorseal: www.rectorseal.com.
      d. STI/SpecSeal: www.stifirestop.com.
      e. Tremco: www.tremcosealants.com.
      f. Substitutions: Refer to Section 01 60 00 – Product Requirements.
   2. All firestopping systems shall be provided by the same manufacturer.
   3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.
   4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
   5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
   6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

B. NON-RATED PENETRATIONS:
   1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.
   2. At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

B. Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand. Backfill above the bedding shall be thoroughly compacted excavated material free of construction debris, large stones, organic, perishable, and frozen materials. Refer to Division 31 Earthwork.

C. Take care during bedding, compaction and backfill not to disturb or damage piping.

D. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

E. Install underground tracer wire and warning tape above piping, refer to Section 22 10 05

F. Refer to Division 1, General Requirements.

3.2 SHEETING, SHORING AND BRACING

A. Provide shoring, sheet piling and bracing in conformance with the Oklahoma Code Requirements to prevent earth from caving or washing into the excavation.

B. Refer to Division 1, General Requirements.

3.3 DEWATERING

A. Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances.

B. Refer to Division 1, General Requirements.

3.4 ROCK EXCAVATION

A. Refer to Division 1, General Requirements.

3.5 CONCRETE WORK

A. Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

3.6 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements.

3.7 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.8 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.9 COORDINATION

A. Coordinate all work with other Contractors prior to installation. Any work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.10 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.11 SLEEVES

A. Provide galvanized sheet metal sleeves or factory fire sleeve assembly for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required.

B. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

C. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.

D. In all piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend minimum 1 inch above the adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure.

3.12 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:
   1. Install approved product in accordance with the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.

B. NON-RATED PARTITIONS:
   1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.
   2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

3.13 OWNERS TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified under Division 1.

B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.

END OF SECTION

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

1.2 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2007.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

1.4 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.6 ELECTRICAL COORDINATION

A. All starters, disconnects, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are provided by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

B. Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be made to any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the Engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this Contractor will be the responsibility of this Contractor.

C. Engineer must coordinate specified voltages with the electrical consultant for the project. The Electrical Contractor will provide all power wiring and the Plumbing Contractor will provide all control wiring. Control wiring shall conform to Division 26 requirements for Control Wiring.

D. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.7 PRODUCT CRITERIA

A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splash proof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2008.

B. EJMA (STDS) - EJMA Standards; Expansion Joint Manufacturers Association; 2003.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. Metraflex Company: www.metraflex.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Inner Hose: Stainless Steel.

C. Exterior Sleeve: Single braided, Stainless Steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:
   1. Mercer Rubber Company: www.mercer-rubber.com.
   2. Metraflex Company: www.metraflex.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Application: Copper piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2007.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.4 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:
   1. H. O. Trerice: www.trerice.comwww.trerice.com.
   2. Weksler: www.weksler-gauges.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Pressure Gages: ASME B40.100, UL 393 or UL 404 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube or Cast aluminum with phosphor bronze bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.2 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Stainless Steel, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   2. H. O. Trerice: www.trerice.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear glass.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E 77.
   5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.

C. Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

D. Install pressure gages with pulsation dampers. Provide gage cock or needle valve to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 SCHEDULES

A. Pressure Gages, Location and Scale Range:
   1. Pumps, 0 to 150 psi.
   2. Expansion tanks, 0 to 150 psi.
   3. Water service pressure reducing valve, 0 to 150 psi.

B. Stem Type Thermometers, Location and Scale Range:
   1. Domestic Hot water supply and recirculation, 30 to 240 Deg. F.

END OF SECTION

SECTION 22 05 48 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vibration isolators.

1.2 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Isolation Technology, Inc: www.isolationtech.com.

B. Kinetics Noise Control, Inc: www.kineticsnoise.com.

C. Mason Industries: www.mason-ind.com.

D. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 VIBRATION ISOLATORS

A. Restrained Open Spring Isolators:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   4. Restraint: Provide heavy mounting frame and limit stops.
   5. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

B. Neoprene Pad Isolators:
   1. Rubber or neoprene waffle pads.
      a. Hardness: 30 durometer.
      b. Thickness: Minimum 1/2 inch.
      c. Maximum Loading: 50 psi.
      d. Rib Height: Maximum 0.7 times width.
   2. Configuration: Single layer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Major Components: Nameplates.

B. Piping: Tags or Pipe markers.

C. Pumps: Nameplates.

D. Small-sized Equipment: Tags.

E. Tanks: Nameplates.

F. Valves: Tags.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.

C. Seton Identification Products: www.seton.com.

D. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.4 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.5 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Identify valves in main and branch piping with tags.

F. Identify piping, concealed or exposed with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

B. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

D. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience. Products shall be manufactured at facilities certified and registered to conform to ISO 9001 Quality Standard.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum with minimum three years of documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect materials against damage before, during and after installation. No material shall be installed that has become damaged in any way.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

2.2 GLASS FIBER

A. Manufacturers:
1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corporation: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.
1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film with self-sealing longitudinal closure laps and butt strips; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:
1. Compatible with insulation.

F. Insulating Cement/Mastic:
1. ASTM C 195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
1. Cloth: Untreated; 9 oz/sq yd weight.
2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5x5 10x10.

H. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell International: www.armacell.com.
2. Aeroflex: www.aeroflexusa.com.
3. Nomaco Insulation: www.nomacoinsulation.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Insulation: Preformed closed cell flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www. jm.com.
      b. Knauf Insulation: www.knaufusa.com.
      c. Substitutions: Refer to Section 01 60 00 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

2.5 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers:
   1. B-Line: www.bline.com.
   2. Pipe Shields: www.pipeshieldinc.com.
   3. Value Engineered Products: www.valueng.com.
   4. Substitutions: Submit information and coordinate approval with the Owner and Engineer.

B. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where Contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

D. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1” x 6” block for piping through 2-1/2” and three 1” x 6” blocks for piping through 4”. Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

E. Wood blocks will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.

E. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

F. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with factory molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

I. Inserts and Shields:
1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4” and smaller copper piping provided 12” long 22 gauge pipe shields are used.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket. Provide inserts to maintain piping in center of pipe sleeves.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. .

K. Valves and fittings: Provide valve handle extensions for all valves installed in insulated piping.

L. Buried Insulated Domestic Water Piping: Provide PVC sleeve at concrete floor penetrations with sleeve stubbed up 2 inches above floor. Seal opening between sleeve and pipe insulation watertight.

M. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

N. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

3.3 SCHEDULES

A. Plumbing Systems:
1. Domestic Water Supply Above Grade: Hot Water, Cold Water and Circulating Water.
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: Mains and branch lines all 1 inch.
2. Domestic Water Supply Below grade: Hot Water and Cold Water.
   a. Preformed Flexible Elastomeric Cellular Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 inch.
      3) Insulation rated for direct burial.
      4) Insulate cold water lines in pipe sleeves at concrete penetrations only.

5) Hot water lines insulated for entire length below grade.

3. Roof Drain Bodies:
   a. Glass Fiber Insulation, 1” thick.
4. Roof Drainage Above Grade:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
   b. Thickness: Mains and branch lines 1 inch.
   c. Insulate piping from overflow roof drain down to wall downspout connection.
   d. Insulate piping from primary roof drain down to 6” above floor penetration.
5. Sanitary Waste Piping above ceilings.
   a. Glass Fiber Insulation:
      1) Pipe Size: All sizes.
   b. Thickness 1 inch.

END OF SECTION

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SECTION 22 10 05 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Storm sewer.
   3. Domestic water.
   4. Natural Gas.

1.2 RELATED REQUIREMENTS

A. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

C. Section 22 07 19 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

D. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).

E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

F. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

G. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

H. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

I. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2005.

J. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

K. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2008.

L. ASTM F 441/F 441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2002.

M. ASTM F 876, ASTM F 877 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing
   1. Engel or PEX-a method.

N. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

P. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2009.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of Oklahoma standards.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welder Qualifications: Certified in accordance with ASME B31.9 Building Services Piping.

D. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Oklahoma, City of El Reno plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 888 or CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: ASTM C1277 or CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

B. PVC Pipe: Schedule 40 ASTM D 2665.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. PVC Pipe: Schedule 40 ASTM D 2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.3 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110, ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.
   3. Application: water service piping into building.

B. Copper Pipe: ASTM B 88, Type K (Annealed Temper).
   1. Fittings: cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.
   2. Joints: No joints below grade.
   3. Application: piping for trap primers.

C. Cross-Linked Polyethylene Tubing (PEX-a or Engel method): ASTM F 876, ASTM F 877:
   1. Fittings: ASTM F 1960.
   2. Joints: No joints located below grade.
   3. Install per manufacturer's instructions.
   4. Provide PVC sleeve at penetrations of concrete floor.
   5. Approved for contact with potable water in accordance with NSF 61 and NSF 14.

D. PVC Pipe: ASTM D 2241 IPS Gasketed Pipe.
   1. Joints: Integral bell and gasket.
   2. Approved for contact with potable water in accordance with NSF 61 and NSF 14.

E. Polypropylene (PP-R) pipe: ASTM F2389.
   1. Fittings: ASTM F2389, heat fusion type.
   2. Domestic hot water piping shall contain a fiber layer (faser) to restrict thermal expansion.
   3. All pipe shall comply with the rated pressure requirements of ASTM F 2389.
   4. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11, SDR 7.4 and 6 approved for hot and cold water. SDR 11 is approved for cold water use only.
   5. Underground Piping: Polypropylene (PP-R) piping in SDR 7.4,11, or 17.6 per manufacturer's instructions and ASTM D2774.

F. Tracer wire for plastic pipe: Magnetic detectable conductor, plastic covering, rated for underground service, imprinted with words "Water Service".

2.4 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.
   3. Mechanical press sealed fittings, 65 mm (2-1/2") in size and smaller. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Fittings shall be double pressed type NSF/ANSI 61 approved and utilize EPDM sealing elements. Sealing elements shall be factory installed.

B. Cross-Linked Polyethylene Tubing (PEX-a or Engel method): ASTM F 876, ASTM F 877.
   1. Fittings: ASTM F 1960.
   2. Locations: concealed branch lines to individual fixture, no exposed tubing.
   3. Install per manufacturer's instructions.
   4. Approved for contact with potable water in accordance with NSF 61 and NSF 14.

C. Polypropylene (PP-R) pipe: ASTM F2389.
   1. Fittings: ASTM F2389, heat fusion type.
   2. Domestic hot water piping shall contain a fiber layer (faser) to restrict thermal expansion.
   3. All pipe shall comply with the rated pressure requirements of ASTM F 2389.
   4. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11, SDR 7.4 and 6 approved for hot and cold water. SDR 11 is approved for cold water use only.

2.5 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: Schedule 40 ASTM D 2665 or ASTM D 3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.6 STORM WATER PIPING, ABOVE GRADE

A. PVC Pipe: Schedule 40 ASTM D 2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

B. Cast Iron Pipe: ASTM A 888 or CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: ASTM C 1277 or CISPI 310, Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.7 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
   2. Joints: NFPA 54, threaded or welded to ASME B31.1,

B. Corrugated Stainless Steel Tubing (CSST): ANSI LC-1 Standard, ASTM A240, Type 304, 321 stainless steel with 2400 degrees F melting point.
   1. Jacket: UV resistant polyethylene with 350 degrees F melting point and fire-resistance tested in accordance with ASTM E84.
   2. Fittings: Mechanical type complying with ASTM B 16.
   3. Use CSST tubing for branch lines or equipment connections. Do not use for mains or exterior use.

2.8 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.9 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Drain, Waste, and Vent:
1. Conform to MSS SP-58, MSS SP-69, MSS SP-89.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/ Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel Unistrut channels or equal with clamps and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.

B. Plumbing Piping - Water:
1. Conform to MSS SP-58, MSS SP-69, MSS SP-89.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel Unistrut channels or equal with clamps and hanger rods.
6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.10 BALL VALVES

A. Manufacturers:
1. Watts: www.watts.com.
2. Webstone Valve: www.webstonevalves.com.
3. Apollo valves: www.apollovalves.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union. Provide valve stem extensions for valves installed in all piping with insulation.
1. Domestic water: valves shall be lead-free (NSF/ANSI 372) and comply with NSF/ANSI 61 for potable water.

C. Ball valves – natural gas
1. 4" and smaller: Ball or eccentric plug valve, bronze or cast iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L listed for use as natural gas shut-off.

2.11 FLOW CONTROLS

A. Manufacturers:
   1. ITT Bell & Gossett: www.bellgossett.com.
   2. Griswold Controls: www.griswoldcontrols.com.
   3. Taco, Inc.: www.taco-hvac.com.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.12 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Watts: www.watts.com.
   2. Apollo Valves: www.apollovalves.com.
   3. Nibco: www.nibco.com.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Lead-free design, Class 125, bronze body, stainless steel trim, stainless steel springs, bronze or alloy disc, or Teflon seats, Buna N or PTFE seals, sweat, threaded or press-fitting ends.

2.13 RELIEF VALVES

A. Temperature and Pressure Relief:
   1. Manufacturers:
      a. Taco: www.taco-hvac.com.
      b. Watts Regulator Company: www.wattsregulator.com.
      c. Substitutions: Refer to Section 01 60 00 - Product Requirements.
   2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labeled.

2.14 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc.: www.armstronginternational.com.
   2. Watts: www.watts.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Size 2 inch and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with International Plumbing Code and local codes.

B. Install in accordance with manufacturer's instructions.

C. Provide tracer wire for below grade non-metallic piping.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom, conserve space, and not interfere with use of space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19 Plumbing Piping Insulation.

J. Establish elevations of buried piping outside the building to ensure proper cover.

K. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Provide support for utility meters in accordance with requirements of utility companies.

N. Excavate in accordance with Section 31 23 16 Excavation.

O. Backfill in accordance with Division 31 - Earthwork.

P. Install valves with stems upright or horizontal, not inverted.

Q. Install water piping to ASME B31.9.

R. Where exterior water piping crosses a sanitary sewer, provide vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

T. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer’s installation instructions. The joints shall be pressed using the tool(s) approved by the fitting manufacturer.

U. Sleeve pipes passing through partitions, walls and floors. . Provide allowance for thermal expansion and contraction of pipe passing through penetration with insulation and appropriately sized sleeve. Penetrations of fire resistant rated assemblies shall maintain the rating of the assembly.

V. Pipe Hangers and Supports:
   1. Install in accordance with MSS SP-58, MSS SP-69, MSS SP-89.
   2. Support horizontal piping as scheduled.

3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping sheet lead packing between hanger or support and piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 05 48.
11. Support cast iron drainage piping at every joint.

W. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.

X. Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.

Y. Natural Gas:
1. Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main. Teflon tape is acceptable for use on natural gas lines.
2. Do not install gas pipe in a ventilation air plenum.
3. Clean all gas piping before all regulators and service valves are installed and before unit connections are made. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.
4. Provide anodeless riser assembly for transition between below grade gas pipe to above grade pipe.
5. Install a shut off valve at each appliance. Provide a valve connection at the main for equipment and appliances furnished by others.
6. Piping through a roof shall be run through an approved roof penetration housing.
7. Each gas pressure reducing valve vent and relief valve shall have a vent limiter or vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.
8. Paint all exposed natural gas pipe with zinc rich primer and two coats of enamel formulated paint for metal surfaces. Color to be yellow or as selected by Architect.

Z. Install pipe identification per Section 22 05 53, this section and all applicable codes.

3.4 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install ball, valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball, valves for throttling, bypass, or manual flow control services.

E. Provide spring loaded check valves on discharge of water pumps.

F. Provide ball valves in natural gas systems for shut-off service.

G. Provide flow controls in water recirculating systems where indicated.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot for piping less than 3 inches and 1/8 inch per foot slope for piping 3 inches or greater for interior piping. Install exterior piping pitched to drain at indicated elevations and slope.

B. Water Piping: Slope piping to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system as required.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Disinfect water distribution system as required IPC 2015 and local plumbing codes.

D. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal above grade piping until it has been successfully tested.

B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

D. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

E. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

F. Entire test must be witnessed by the Authority Having Jurisdiction.

G. Leak test: Shall conform to requirements of IPC and local codes.
   1. Water supply system.
   2. Drainage and vent system.

H. Gas piping systems:
   1. Perform initial pressure test prior to concealing tubing with wall and ceiling finishes and before connecting appliances.
   2. Perform final pressure test after construction is complete and finishes applied, system may be re-tested to verify no damage has occurred to gas piping system.
   3. Connect appliances and equipment to gas piping system and test connections for leakage.

3.8 SERVICE CONNECTIONS

A. Sanitary and storm sewer: Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage. Sewer stubbed up to building by others.

B. Water service: Provide new water service into building from city water main stubbed up to building by others.

C. Natural gas: Connect new natural gas piping to meter. Gas service and meter at building by gas company. Gas service to building at minimum 2 PSI. Coordinate new gas load with gas utility company.

3.9 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches and larger:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 4 ft.
         2) Hanger rod diameter: 3/8 inch.
   3. Cross-linked Polyethylene (PEX-a) piping:
      a. All Sizes:
         1) Maximum hanger spacing: 2’-8”.
         2) Hanger rod diameter: 3/8 inch.
         3) Hanger spacing per piping manufacturer’s instructions.
      b. The use of horizontal rigid metal channel supporting the tubing with hangers spaced at maximum of 6 ft per tubing manufacturer’s instructions shall be allowed with approval of local plumbing code.

END OF SECTION

SECTION 22 10 06 - PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Hydrants.

D. Water boxes.

E. Trap guards

F. Backflow preventers.

G. Water hammer arrestors.

H. Interceptors.

I. Thermostatic mixing valves.

J. Thermostatic balancing valves.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 30 00 - Plumbing Equipment.

C. Section 22 40 00 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers; 2003.

C. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

D. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2002 (ANSI/ASSE 1012).

E. ASSE 1013 - Reduced Pressure Principle Backlow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 2005.

F. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2004, and Errata 2005 (ANSI/ASSE 1019).

G. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Refer to Section 01 60 00 - Product Requirements for additional provisions.
2. Extra Loose Keys for Outside wall hydrants: Two.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.1 DRAINS

A. Manufacturers:
1. Zurn Industries, Inc.: www.zurn.com.
2. Watts: www.watts.com.
3. Jay R. Smith Manufacturing Company: www.jrsmith.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Roof Drains:
1. Assembly: ASME A112.6.4.
2. Body: Lacquered cast iron with sump. Cast iron dome strainer integral gravel stop, membrane flange and adjustable deck clamp as required for installation.
3. Overflow Roof Drains: include 2” high water dam.

C. Downspout Nozzles:
1. Bronze round with offset bottom section and wall flange.

D. Floor Drain:
1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round height adjustable nickel-bronze strainer.
2. Provide vandal-resistant strainer screws.

E. Floor Sink:
1. Square cast iron body with white acid resistant coating, integral clamp collar, sediment bucket, and non-tilt loose set grate type as listed in schedule.

F. Trench Drain:
1. Modular precast polyester concrete channel of interlocking design with built-in slope of 0.5%. Channel has an integral metal rail, radiused bottom, grate width of 6”. Bottom outlet, and end caps. Channel sections 1 meter long.
2. Wash-bays in Areas B and C: 1/4" diameter perforated 304 stainless steel 14 gage grate, load class C with stainless steel metal rails. 6” bottom outlet.
3. Maintenance building: longitudinal galvanized steel slot bar grate, load class C with 4” bottom outlet.

G. Refer to Plumbing Fixture Schedule on plans.

2.2 CLEANOUTS

A. Manufacturers:
1. Wade Drains: www.wadedrains.com.
2. Zurn Industries, Inc.: www.zurn.com.
3. Watts: www.watts.com.
4. Jay R. Smith Manufacturing Company: www.jrsmith.com.
5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Cleanouts at Exterior Unsurfaced Areas:
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover. Cast iron cleanout ferrule with threaded brass raised head. Access housing with adjustable anchor flange and extra heavy secured scoriated ductile iron cover. Provide concrete pad for cleanout. Cover secured with vandal-proof screws.

C. Cleanouts at Interior Finished Floor Areas:
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas. Cover secured with vandal-proof screws.

D. Cleanouts at Interior Finished Wall Areas (CO-4):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with vandal-proof screw.

E. Cleanouts at interior exposed areas:
1. Line type cast iron cleanout tee with tapered threaded brass or bronze closure plug.

F. Refer to Plumbing Fixture Schedule on plans.

2.3 HYDRANTS

A. Manufacturers:
1. Woodford Manufacturing: www.woodfordmfg.com.
2. Jay R. Smith Manufacturing Company: www.jrsmith.com.
3. Super Klean:
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Exterior Wall Hydrants:
1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall box with hinged door hose thread spout, removable key and integral vacuum breaker.

C. Roof Hydrants:
1. ASSE 1052; Freezeproof / Pollution-proof post-type, with below-roof reservoir with locking handle, 3/4" inlet, 3/4" hose thread, ASSE 1052 backflow preventer outlet, 1-1/4" galvanized steel casing pipe, schedule 80 PVC pipe reservoir, teflon packing, flow-finder flow plunge freeze resistant, self-draining type, roof mounting hardware.

D. Pedestal Hydrants: Automatic draining freezeless yard hydrant with 1-1/4” galvanized steel pipe, lever handle operation, 3/4" threaded hose connection with backflow preventer (ASSE 1052).

E. Interior hose bibs – tempered water: brass ball valve with wall mount bracket, temperature gauge and stainless steel wall mount hose rack.

F. Refer to Plumbing Fixture Schedule on plans.

2.4 WASHING MACHINE BOXES AND VALVES

A. Box Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com.

2. Oatey: www.oatey.com.
3. Sioux Chief:.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Description: Plastic preformed rough-in box with brass quarter turn brass valves, water hammer arrestors, socket for 2 inch waste, slip in finishing cover.

C. Refer to Plumbing Fixture Schedule on plans.

2.5 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com.
2. Oatey: www.oatey.com.
3. Sioux Chief:
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Description: Plastic preformed rough-in box with quarter turn brass valve, water hammer arrestor, slip in finishing cover.

C. Refer to Plumbing Fixture Schedule on plans.

2.6 BACKFLOW PREVENTERS

A. Manufacturers:
1. Watts Regulator Company: www.wattsregulator.com.
2. Zurn Industries, Inc.: www.zurn.com.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Intermediate Atmospheric Vented Backflow Preventers: ASSE 1012, same size as pipe, with intermediate atmospheric vent between independent check valves, bronze body with union ends, stainless steel springs, rated for 175 psig and 210^{o}F. Watts 9DM or equal.

C. DUAL CHECK WITH ATMOSPHERIC VENT FOR CO_2 POST MIX VENDING MACHINES: 3/8”, stainless steel body and parts, dual check with third ball check outlet, rated for 150 psig and 140^{o}F. Watts 9BD or equal.

D. HOSE CONNECTION VACUUM BREAKERS: ASSE 1052, brass or bronze construction, EPDM diaphragm and seat, rated for 125 psig and 180^{o}F. .

E. HIGH HAZARD ANTI-SIPHON, ANTI-SPILL VACUUM BREAKERS: ASSE 1056, same size as pipe, brass or bronze construction, silicone rubber discs, stainless steel springs, inlet and outlet ball shutoff valves, with test cocks, anti-spill design, rated for 150 psig and 180 deg. F max.. Watts 008QT or equal.

F. Reduced Pressure Zone Assembly: ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, four test cocks and air gap apparatus on drain. Watts LF919-QT-S or approved equal.

2.7 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Watts Regulator Company: www.wattsregulator.com.
2. Zurn Industries, Inc.: www.zurn.com.
3. Precision Plumbing Products (PPP) Industries: www.pppinc.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.8 INTERCEPTORS

A. Manufacturers:
1. Schier Products: www.schierproducts.com.
2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Grease Interceptors:
1. High Density Polyethylene construction, interior below floor installation, anchor flange, adjustable risers to provide heavy duty gas tight access cover flush with finished floor.
1. Multi-weir baffle assembly, integral deep seal trap, removable integral flow control.

C. Refer to Schedules on plans.

2.9 MIXING VALVES

A. Thermostatic Mixing Valves:
1. Manufacturers:
a. Watts: www.watts.com.
b. Bradley Corporation: www.bradleycorp.com.
c. Lawler Valves: www.tempered water.com.
2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Point-of-use Valve: Lead free brass body, stainless steel or copper alloy, integral temperature adjustment, check valves. At fixture ASSE 1070.

C. Wash-bays: digital water temperature control and monitoring system, programmable temperature output settings, range of 60 – 180 Degrees F. If power failure system will open full cold supply. If loss of cold water system will close hot water supply. Main valve ASSE 1017 listed. Valve enclosed in wall mounted stainless steel box.

D. Refer to Schedules on plans.

2.10 TRAP GUARDS

A. Manufacturers:
1. ProSet Systems Trap Guard.
2. RectorSeal: www.rectorseal.com.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4” size.

C. Refer to Plumbing Fixtures Schedule on plans. Provide as required by local codes.

2.11 THERMOSTATIC BALANCING VALVES

A. Manufacturers:
1. Acorn Engineering:
2. Caleffi North America, Inc: www.caleffi.com.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Valve: thermostatically controlled balancing valve shall be self contained and fully automatic. Valve shall regulate flow of recirculated domestic hot water based on water temperature entering valve regardless of system operating pressure. When fully closed the valve shall bypass a minimum amount of hot water to maintain dynamic control of the recirculating loop. Valve shall be NSF-61 certified for use in all domestic water systems.

C. Refer to Plumbing Fixture Schedule on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rotting of drainage system.

D. Encase exterior cleanouts in concrete flush with grade.

E. Install floor cleanouts at elevation to accommodate finished floor.

F. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur.

G. Pipe relief from backflow preventer to nearest drain.

H. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping as shown on plans plus on quick closing valves, flush valves and solenoid valves.

I. Install washing machine boxes in wall construction, secured to structure, directly behind proposed washing machine location. Provide water hammer arrestors in supply piping. Mount box a min. of 36” above floor.

J. Install backflow preventers in accordance with Oklahoma requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

K. Install trap guard assemblies in floor drains, floor sinks and hub drains per manufacturer’s instructions.

L. Mount wall hydrants recessed in exterior wall construction with valve plug extended beyond interior side of building insulation. Slope to drain to exterior. Install so discharge is 18” min. above finished grade. Set wall box in grout or caulk and fill exterior wall penetration with insulation.

M. Roof hydrants: Coordinate roof hydrant installation with roofing contractor. Install hydrant per manufacturer’s recommendations.

N. Install interior grease interceptor tank below floor with required extension risers to provide access covers flush with finished floor. Installation of unit per manufacturer’s recommendations and per local codes.

O. Equipment by others: Provide rough-in piping and make final and necessary connections as required by equipment supplier.

P. Thermostatic balancing valve: Installation of valve shall be made by qualified tradesmen. Install valve in each domestic hot water return piping branch beyond last hot water device in that branch. Provide suitable line size isolation valves, unions, and strainer as recommended by manufacturer. Provide suitable access panel as required in non-accessible ceilings and walls.

Q. Mount yard hydrants with discharge 27" min. above finished grade. Set base of hydrant in 1 cu. yd. of granular backfill material for free drainage. Crown finished grade materials for drainage away from hydrant.

3.2 OWNER TRAINING

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

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SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water Heaters.

B. Electronic Descaler.

C. Thermal expansion tanks.

D. Circulation Pumps.

1.2 RELATED REQUIREMENTS

A. Section 26 27 02 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ANSI Z21.10.3 - Gas Water Heaters - Volume III - Storage Water Heaters with Input Ratings above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters; 2008.

B. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.

C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Project Record Documents: Record actual locations of components and.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 CERTIFICATIONS

A. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as applicable, in addition to requirements specified elsewhere.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. Refer to Section Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

PART 2 - PRODUCTS

2.1 COMMERCIAL GAS-FIRED WATER HEATERS – TANKLESS TYPE

A. Manufacturers:
1. Navien Inc.: www.navien.com.
2. Rinnai American Corporation: www.rinnai.us.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Type: Type: Tankless, automatic, natural gas-fired, modulating burner with 10-1 turn down ratio, high efficiency, sealed combustion, condensing, direct vent exhaust and air intake, wall mounted. Unit shall have built-in control panel with diagnostics display. Multiple units shall be connected with communications cable from manufacturer.

C. Performance: Refer to Water Heater Schedule on plans.

D. Accessories: Provide:
1. Temperature and Pressure Relief Valve: ASME labeled.
2. Wall mounted support.
3. Ball valves and unions at pipe connection points.
4. Ready-Link Communications Cable
5. Condensate drain neutralizer kit piped to floor sink.
6. Coordinate 120 volt outlet for power supply with Electrical Contractor.
7. Provide common vent backflow damper collar kit.

E. Venting: PVC, CPVC or ABS combustion air intake and flue gas outlet with DWV solvent weld fittings per manufacturer’s instructions.

2.2 COMMERCIAL ELECTRIC WATER HEATERS - TANKLESS TYPE

A. Manufacturers:
1. Chronomite: www.chronomite.com.
2. EeMaxx: wwweemaxinc.com.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Type: Factory-assembled and wired, electric, with ASME rating. Tankless water heater with digital microprocessing temperature control, floor mounted cabinet enclosure, internal thermostat with auto reset high limit switch, low and high flow activation, single point power connection, relief valve. Unit shall be designed to serve emergency shower/eyewash units.

C. Refer to Water Heater Schedule on plans.

2.3 ELECTRONIC DESCALER

A. Manufactuer:
1. Clear Water Enviro technologies; model Scaleblaster SB-250.
2. Substitutions: Refer to Bidding Requirements and Division 1 - General Requirements.

B. Electronic descaler to prevent calcium build-up in piping. Install unit on wall next to water heaters, coil wiring installed on cold water supply pipe to water heater per manufacturer's instructions. Coordinate 120 volt outlet for power supply with electrical contractor.

C. Refer to Plumbing Schedules on plans.

2.4 THERMAL EXPANSION TANKS

A. Manufacturers:
1. Amtrol Inc.: www.amtrol.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Wessel Company: www.westank.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Construction: Welded steel, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles. NSF/ANSI 61 listed for potable water.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 40 psig.

2.5 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Pumps Inc.: www.armstrongpumps.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Grundfos Pumps Corporation: www.grundfos.us.
4. Taco Inc: www.tac-hvac.com.
5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Type: Wet rotor with brass, bronze or stainless steel body, 150 psig maximum working pressure at operating temperature of 225 F continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

C. Controls: electric timer and aquastat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping, gas venting, ductwork, and electrical work to achieve operating system. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

C. Provide accessories as required for a complete operating system.

D. Startup and test equipment adjusting operating and safety controls for proper operation. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

E. Domestic Water Heat Heaters: Pipe relief valves and drains to nearest floor sink or drain.

F. Mount commercial tankless type water heaters on wall. Adjust and level equipment. Route drain outlets to nearest floor sink, hub drain or floor drain

G. Connect equipment to water and drain piping using unions or flanges and isolation valves.

H. Pitch condensate drain piping to floor drains or open site drains. Provide water heater condensate neutralizer kit and install per manufacturer’s recommendations.

I. Route water heater venting thru roof or sidewall and terminate per manufacturer’s instructions. Maintain proper code required clearances to openings and mechanical equipment on roof.

J. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

K. Adjust compression tank precharge to scheduled minimum operating pressure prior to connecting to system.

L. Pumps:
1. Circulating pumps: Provide line sized isolating valve, balancing valve and thermometer on suction and line sized soft seated check valve and isolating valve on discharge.
2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.2 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 1 hour.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water Closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Electric water coolers.

F. Service sinks.

G. Showers.

H. Commercial Kitchen fixtures.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 10 06 - Plumbing Piping Specialties.

C. Section 22 30 00 - Plumbing Equipment.

D. Section 26 27 02 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2006.

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).

C. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.

D. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

PART 2 - PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. Water Closet Manufacturers:
   1. American Standard Inc.: www.americanstandard.com.
   2. Kohler Company: www.kohler.com.
   3. Sloan Valve Company: www.sloanvalve.com.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Water Closets: Vitreous china, ASME A112.19.2, elongated rim, wall and floor mounted, siphon jet flush action, china bolt caps. Flush volume 1.6 gallons. Color white.

C. Flush Valves: ASME A112.18.1, Exposed chrome plated, diaphragm type, complete with vacuum breaker stops and accessories. Vandal resistant stop cap. 1.6 gallon flush volume.
   1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and mechanical over-ride push button.

D. Flush Valve Manufacturers:
   a. Sloan Valve Company: www.sloanvalve.com.
   b. Substitutions: Refer to Section 01 60 00 - Product Requirements.

E. Seats:
   1. Manufacturers:
      a. Bemis Manufacturing Company: www.bemismfg.com.
      b. Kohler Company: www.kohler.com.
      c. Comfort Seats: www.comfort-seat.com.
      d. Substitutions: Refer to Section 01 60 00 - Product Requirements.
   2. Solid white plastic, elongated, open front, extended back, self-sustaining hinge, external check hinge with stainless steel posts, without cover.

F. Water Closet Carriers – wall hung:
   1. Manufacturers:
      a. Zurn Industries, Inc.: www.zurn.com.
      b. Wade Drainage Products: www.wadedrains.com.
      c. Watts: www.watts.com.
      d. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

G. Refer to Plumbing Fixture Schedule on plans.

2.2 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:
1. American Standard Inc.: www.americanstandard.com.
2. Kohler Company: www.kohler.com.
3. Sloan Valve Company: www.sloanvalve.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Valve: Exposed, top spud
2. Removable stainless steel strainer.

C. Flush Valves: ASME A112.18.1, Exposed chrome plated, diaphragm type, complete with vacuum breaker stops and accessories. Vandal resistant stop cap. 0.5 gallons flush volume.
1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and mechanical over-ride push button.

D. Flush Valve Manufacturers:
a. Sloan Valve Company: www.sloanvalve.com.
b. Substitutions: Refer to Section 01 60 00 - Product Requirements.

E. Carriers:
1. Manufacturers:
a. Wade Drains: www.wadedrains.com.
b. Zurn Industries, Inc.: www.zurn.com.
c. Watts: www.watts.com.
d. Substitutions: Refer to Section 01 60 00 - Product Requirements.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

F. Refer to Plumbing Fixture Schedule on plans.

2.3 LAVATORIES

A. Lavatory Manufacturers:
1. American Standard Inc.: www.americanstandard.com.
2. Kohler Company: www.kohler.com.
3. Sloan Valve Company: www.sloanvalve.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Vitreous China Wall Hung Basin: ASME A112.19.2, rectangular basin with splash lip, front overflow. Refer to Architectural plans for mounting heights.

C. Vitreous China Counter Top Basin: ASME A112.19.2; vitreous china self-rimming counter top lavatory, with drillings on 4 inch centers, front overflow, seal of putty, calking, or concealed vinyl gasket.

D. Supply Faucet Manufacturers:
1. Delta Faucet Company: www.deltacommercialfaucets.com.
2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

E. Sensor Operated Faucet: ASME A112.18.1; chrome plated metal construction, battery powered, integral thermostatic mixing valve (ASSE 1070 listed), flow of 0.5 gallons per minute, adjustable temperature limit stops, ADA compliant.

F. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Waste with open grid strainer.
3. Commercial grade quarter turn supply stops with removable handle or loose key.
4. Supply lines: rigid chrome plated or flexible stainless steel.
5. ADA compliant piping covers.
6. Thermostatic mixing valve comply with ASSE 1070.

G. Carrier:
1. Manufacturers:
a. Zurn Industries, Inc.: www.zurn.com.
b. Wade Drains: www.wadedrains.com.
c. Watts: www.watts.com.
d. Substitutions: Refer to Section 01 60 00 - Product Requirements.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, bearing plate and studs for back-to-back lavatory installation.

H. Refer to Plumbing Fixture Schedule on plans.

2.4 SINKS

A. Sink Manufacturers:
1. Elkay Manufacturing: www.elkayusa.com.
2. Advance Tabco: www.advancetabco.com.
3. Just Manufacturing:
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Single Compartment Bowl: ASME A112.19.3; 18 gage thick, Type 304stainless steel, self rimming and undercoated, with ledge back drilled for trim.
1. Drain: 3-1/2 inch crumb cup and tailpiece.

C. Double Compartment Bowl: ASME A112.19.3: 18 gage thick, Type 304 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
1. Drain: 3-1/2 inch crumb cup and tailpiece.

D. Supply Faucet Manufacturers:
1. Delta Faucet Company: www.deltacommercialfaucets.com.
2. Chicago Faucets: www.chicagofaucets.com.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

E. Manual Supply Faucet: ASME A112.18.1; chrome plated metal construction, supply fittings, gooseneck spout, ADA compliant single handle.

F. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Commercial grade quarter turn supply stops with removable handle or loose key.
3. Supply lines: rigid chrome plated or flexible stainless steel.
4. Provide below deck thermostatic mixing valve (ASSE 1070) at location indicated on plans.
5. Provide deck mounted air gap for dishwasher.

G. Refer to Plumbing Fixture Schedule on plans.

2.5 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
1. Elkay Manufacturing Company: www.elkay.com.
2. Acorn Engineering Company: www.acorneng.com.
3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Water Cooler: Lead free design, electric 120/60/1, mechanically refrigerated; water filter, hands-free sensor operated water bottle fill station, wall mounted, handicapped accessible; stainless steel top, vandal-resistant. Push button operation. ADA installation.
   1. Dual height units: mount water bottle fill station on lower unit.
   2. Refer to architectural plans for mounting heights.
   3. Provide PVC P-trap.
   4. Commercial grade quarter turn supply stop with flexible stainless steel supply line.
   5. Provide wall carrier or wall supports as required for installation.

C. Refer to Plumbing Fixture Schedule on plans.

2.6 SERVICE SINKS

A. Service Sink Manufacturers:
   1. Fiat Products: www.fiat.ca.
   2. Acorn Engineering Company: www.acorneng.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Bowl: 24 by 24 by 12 inch high, square type, molded stone, floor mounted, 6” drop front with stainless steel threshold and stainless steel flat strainer.

C. Sink Faucet Manufacturers:
   1. Fiat Products: www.fiat.ca.
   2. Chicago Faucets.
   3. T & S Brass: www.tsbrass.com.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

D. Trim: ASME A112.18.1 exposed chrome plated wall type supply with cross or lever handles, adjustable spout wall brace, vacuum breaker, hose end spout, pail hook, integral screwdriver stops with covering caps and wall flanges.

E. Accessories:
   1. Minimum 30 inch hose and wall mounted hose clamp hanger.
   2. Mop hanger with three hanger positions.
   3. Two stainless steel wall guards.
   4. Provide hose connection vacuum breaker with threaded hose outlet for mounting on spout end. Watts 8A or approved equal.
   5. Provide check valves on hot and cold supply lines prior to elbow down in wall.

F. Refer to Plumbing Fixture Schedule on plans.

2.7 SHOWERS

A. Shower enclosure, grab bars and seat by General Contractor.

B. Trim Manufacturers:
   1. Bradley Corporation: www.bradleycorp.com.
   2. Acorn Engineering Company: www.acorneng.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

C. Trim: ASME A112.18.1, ASSE 1016; concealed shower supply with pressure balanced and thermostatic mixing valves, integral service stops, shower head with adjustable spray pattern. Coordinate installation of shower trim location with Architectural plan. Provide floor drain at center of shower stall.
   1. ADA compliant system to include diverter valve, hand wand with flexible metal hose, vacuum breaker and ADA grab bar for mounting hand wand.

D. Refer to Plumbing Fixture Schedule on plans.

2.8 COMMERCIAL KITCHEN FIXTURES

A. Kitchen fixtures furnished by others. Provide rough-in and final connections as required. Coordinate with food service equipment supplier for installation of plumbing fixtures and trim. Refer to food service equipment drawings and Kitchen Plumbing Fixture Schedule on plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install plumbing fixtures in accordance with manufacturer’s instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping. Cover exposed water closet bolts with bolt covers.

B. Install each fixture with trap, easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

C. Provide chrome plated rigid or stainless steel flexible supplies to fixtures with commercial grade quarter-turn loose key or removable handle stops, reducers, and escutcheons.

D. Provide adjustable support bracket with pipe clamps for fastening to wall framing to secure piping stub outs at fixtures. Piping stub outs shall be type L copper.

E. Set floor mounted water closets, floor mounted service sinks; counter mounted lavatories and sinks; lavatory and sink faucets and drains with full setting bed of flexible non-staining plumber's putty. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.

F. Provide unions at water connections and PVC P-traps for electric water coolers.

G. Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass and incased with ADA compliant covers.

H. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

I. Foodservice Equipment: Provide rough-in piping, traps, tailpieces, indirect waste lines and make final and necessary connections for foodservice equipment. Install faucets, spray units, drains, lever drains, vacuum breakers, solenoid valves, check valves, flow control valves, water inlet fittings, filters, strainers, pressure reducing valves and gas valves furnished by foodservice equipment contractor. Provide condensate drain piping from ice machines, coolers and freezer evaporators. Make all final and necessary plumbing connections.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED WORK

A. Section 23 05 13 - Common Motor Requirements for HVAC.

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

C. Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.3 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:

1.	AABC	Associated Air Balance Council.
2.	ABMA	American Boiler Manufacturers Association.
3.	ADC	Air Diffusion Council.
4.	AGA	American Gas Association.
5.	AMCA	Air Movement and Control Association.
6.	ANSI	American National Standards Institute.
7.	AHRI	Air-Conditioning, Heating and Refrigeration Institute.
8.	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers.
9.	ASME	American Society of Mechanical Engineers.
10.	ASTM	American Society for Testing and Materials.
11.	AWWA	American Water Works Association.
12.	AWS	American Welding Society.
13.	CGA	Compressed Gas Association.
14.	EPA	Environmental Protection Agency.
15.	GAMA	Gas Appliance Manufacturers Association.
16.	IEEE	Institute of Electrical and Electronics Engineers.
17.	ISA	Instrument Society of America.
18.	MCA	Mechanical Contractors Association.
19.	MICA	Midwest Insulation Contractors Association.
20.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
21.	NBS	National Bureau of Standards.
22.	NEBB	National Environmental Balancing Bureau.
23.	NEC	National Electric Code.
24.	NEMA	National Electrical Manufacturers Association.
25.	NFPA	National Fire Protection Association.
26.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
27.	UL	Underwriters Laboratories Inc.
28.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
29.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials.
30.	UL1479	Fire Tests of Through-Penetration Firestops.
31.	UL723	Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

B. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.5 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1, General Requirements.

B. Furnish one can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.6 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements.

1.7 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submittals must be reviewed and approved by Engineer and Owner.

C. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

D. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the Engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies. See related comments in Section 23 05 13 - Common Motor Requirements for HVAC Equipment in Part 1 under Electrical Coordination.

E. Include wiring diagrams of electrically powered equipment.

1.8 OFF SITE STORAGE

A. Prior approval by Owner and the Engineer will be needed. The Contractor shall carry insurance for full value, with Owner as beneficiary for consideration of offsite materials storage.

B. Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough in material will not be accepted for offsite storage. For material that can be stored off site, no material will be accepted for offsite storage unless shop drawings for that material have been approved.

1.9 CERTIFICATES AND INSPECTIONS

A. Refer also to the General Conditions for Certificates and Inspections.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1, General Requirements.

B. Assemble material in three ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
1. Copies of all approved shop drawings.
2. Manufacturer's wiring diagrams for electrically powered equipment.
3. Records of tests performed to certify compliance with system requirements.
4. Certificates of inspection by regulatory agencies.
5. Temperature control record drawings and control sequences.
6. Parts list for manufactured equipment.
7. Valve schedules.
8. Lubrication instructions, including list/frequency of lubrication done during construction.
9. Warranties.
10. Additional information as indicated in the technical specification sections.

C. Provide a PDF file copy of all Operation and Maintenance (O&M) Manuals.

1.11 OWNER TRAINING

A. Instruct personnel in the proper operation and maintenance of systems and equipment provided as part of this project; video tape all training sessions. Include not less than 16 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

1.12 RECORD DRAWINGS

A. Refer to Division 1, General Requirements.

B. In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing Contractor/Subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 09 are sufficient; no additional access provisions are required unless specifically indicated.

B. Concealed Spline Ceilings:
1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 09.

C. Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A. Stencils:
   1. Not less than 1 inch high letters/numbers for marking pipe and equipment.

B. Snap-On Pipe Markers:
   1. Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services, or equal.

C. Engraved Name Plates:
   a. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, Brimar Industries, Inc. or W. H. Brady.

D. Valve Tags:
   1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, Brimar Industries, Inc. or W. H. Brady.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated mechanical systems installation in accordance with Division 31 Earthwork. Blasting will not be allowed without written permission of the Engineer and the Owner.

B. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and ensure there is no disturbance of bearing soil.

3.2 CONCRETE WORK

A. All cast in place concrete will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support of mechanical equipment.

3.3 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements.

3.4 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.5 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.6 COORDINATION

A. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi recessed heating and/or cooling terminal units installed in/on architectural surfaces.

B. Coordinate all work with other Contractors prior to installation. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

C. Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.7 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

C. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 - Products.

D. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

E. Use engraved name plates to identify control equipment.

3.8 SLEEVES

A. Pipe Sleeves:
   1. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall.
   2. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.
   3. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.
   4. Extend the top of sleeve 1 inch above the adjacent floor in piping floor penetrations located in the mechanical rooms and wet locations listed below. In finished areas sleeves shall be flush with rough floor.
   5. For floor pipe penetrations through floors in mechanical rooms core drill opening and provide 1-1/2"x 1-1/2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8"on center. Seal corners water tight with urethane caulk. Or, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure.
   6. For pipe penetrations through floors located in food service areas, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. Size sleeve to allow insulated pipe to run through sleeve and paint the sleeve.

B. Duct Sleeves:
   1. Duct sleeves are not required in non-rated partitions or floors.
   2. Provide sleeve required for fire dampers in fire-rated partitions and floors. Reference fire damper details on drawings.
   3. For duct penetrations through mechanical room floors and wet locations listed below, provide 1-1/2"x 1-1/2" x 1/8" galvanized steel angles fastened to floor around the perimeter of the duct opening to prevent water from getting to floor opening. Provide urethane caulk between angles and floor and fasten angles to floor 8" on center. Seal corners water tight with urethane caulk.
   4. Wet locations include:
      a. Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.

3.9 OWNER TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified under Division 1.

END OF SECTION

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. This section includes requirements for single and three phase motors that are used with equipment specified in other sections. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Operating and Maintenance Data.
      h. Electrical Coordination.
      i. Product Criteria.
   2. PART 2 – PRODUCTS.
      a. Three Phase, Single Speed Motors.
      b. Single Phase, Single Speed Motors.
      c. Motors Used with Variable Frequency Drives.
      d. Electronically Commutated Motors (ECM).
   3. PART 3 – EXECUTION.
      a. Installation.

1.2 RELATED WORK

A. Section 23 05 14 - Variable Frequency Drives.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Division 26 00 00 - Electrical.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators.

B. ANSI/NEMA MG-1 Motors and Generators.

C. ANSI/NFPA 70 National Electrical Code.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include with the equipment which the motor drives the following motor information: motor manufacturer, horsepower, voltage, phase, hertz, rpm, full load efficiency. Include project wiring diagrams prepared by the Contractor specifically for this work.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data Procedures.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data, supply the following additional documentation:
   1. Lubrication instructions, including list/frequency of lubrication.
   2. Table noting full load power factor, service factor, NEMA design designation, insulation class and frame type for each motor provided.

1.8 ELECTRICAL COORDINATION

A. All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

B. Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the Engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this Contractor will be the responsibility of this Contractor. See related comments in Section 23 05 00 - Common Work Results for HVAC, under Shop Drawings.

C. Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.

D. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.9 PRODUCT CRITERIA

A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splash proof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

2.1 THREE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated 2008, 460 volt, three phase, 60 hertz motors for all motors 1/2 HP and larger unless specifically indicated.

B. Use NEMA general purpose, continuous duty, Design B, normal starting torque, T-frame or U-frame motors with Class B or better insulation unless the manufacturer of the equipment on which the motor is being used has different requirements. Use open drip-proof motors unless totally enclosed fan-cooled, totally enclosed non-ventilated, explosion-proof, or encapsulated motors are specified in the equipment sections.

C. Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for re-lubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at the end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

D. All open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.

E. All motors 1 HP and larger, except specially wound motors and inline pump motors 56 frame and smaller, to be high efficiency design with full load efficiencies which meet or exceed the values listed below when tested in accordance with NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

MOTOR HP	-----Open Drip-Proof Motors------ -------Nominal Motor Speed------- 1200 rpm	1800 rpm	3600 rpm
1	82.5	85.5	77.0
1-1/2	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7-1/2	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2
20	92.4	93.0	91.0
25	93.0	93.6	91.7
30	93.6	94.1	91.7
40	94.1	94.1	92.4

MOTOR HP	----Totally Enclosed Fan-Cooled---- -------Nominal Motor Speed------ 1200 rpm	1800 rpm	3600 rpm
1	82.5	85.5	77.0
1-1/2	87.5	86.5	84.0
2	88.5	86.5	85.5
3	89.5	89.5	86.5
5	89.5	89.5	88.5
7-1/2	91.0	91.7	89.5
10	91.0	91.7	90.2
15	91.7	92.4	91.0
20	91.7	93.0	91.0
25	93.0	93.6	91.7
30	93.0	93.6	91.7
40	94.1	94.1	92.4

2.2 SINGLE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

B. Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

2.3 MOTORS USED WITH VARIABLE FREQUENCY DRIVES

A. In addition to the requirements specified above, the motor must be suitable for use with the drive specified in Section 23 05 14, including but not limited to motor cooling. Motor shall comply with NEMA MG1 Part 31 to provide windings capable to withstand up to 1600 peak Volts with a rise time of 0.1 µs. Provide bearing protection grounding rings to bleed current from the motor shaft to the motor casing.

B. Manufacturers:
   1. Aegis SGR: www.est-aegis.com.
   2. Inpro/Seal CDR: www.inpro-seal.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.4 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Motor to be a brushless DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors. Motors shall be permanently lubricated with heavy duty ball bearings to match the fan load and pre-wired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

B. Provide as Scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

B. When motor will be flexible coupled to the driven device, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator, check the shaft for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

C. When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

D. Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

E. Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION

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SECTION 23 05 14 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SCOPE

A. This section includes variable frequency drives and line reactors. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Submittals.
      f. Operating and Maintenance Data.
      g. Equipment Startup.
      h. Warranty.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Design and Construction.
      c. Performance Requirements.
      d. Control Features.
      e. Protection Features.
      f. Diagnostics.
      g. Quality Assurance Tests.
      h. AC Input Line Reactors.
      i. Output Line Filters.
   3. PART 3 – EXECUTION.
      a. Variable Frequency Drives (VFD).
      b. Owner Training.

1.2 RELATED WORK

A. Section 23 34 00 - HVAC Fans.

B. Section 23 74 13 - Packaged Rooftop Units

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems.

F. Section 26 27 02 - Equipment Wiring Systems.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. ANSI/IEEE 519 Guide for Harmonic Control and Reactive Compensation of Static Power Converters.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include physical, electrical, and performance characteristics of each variable frequency drive and associated components, including dimensions; weight; input and output performance; voltage, phase, current and overcurrent characteristics; installation instructions; protective features; wiring and block diagrams indicating specified options; electrical noise attenuation equipment where required to meet the criteria specified; line side voltage notch wave form and line side current harmonics; certified efficiency versus load and speed curves; and required operating environment.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.7 EQUIPMENT STARTUP AND OWNER TRAINING

A. Provide the services of a factory trained and certified technician to approve the installation; start-up, test, and adjust for proper operation of the unit(s). Upon completion of the equipment startup, submit a complete manufacturer's field report, including startup and test log, signed by the factory trained technician. Coordinate with the Temperature Control Contractor and the Balancing Contractor. The startup shall be coordinated with Division 26 Electrical and shall be completed within ten (10) working days from the startup date as set by the Owner's representative.

1.8 WARRANTY

A. The warranty shall be for a period of twenty-four (24) months from the date of project Substantial Completion. Further, the warranty shall include all parts, labor, travel time, administrative costs, overhead, travel expenses, technical support and any and all other costs to provide the warranty service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.abb.com.

B. Toshiba: www.toshiba.com.

C. Danfoss: www.danfoss.com.

D. GE Fuji: www.geindustrial.com.

E. Saftronics: www. saftronics.com.

F. Yaskawa: www.yaskawa.com.

G. Eaton/Cutler Hammer: www.eaton.com.

H. Mitsubishi: www.meau.com.

I. Allen Bradley: www.ab.com.

J. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 DESIGN AND CONSTRUCTION

A. The unit shall be variable torque, modular design for control of the motors as specified in Division 23 and rated at the motor full load nameplate amps.

B. The unit shall be U.L. listed, solid state, microprocessor-based with a pulse width modulated (PWM) output wave form (none others are acceptable).

C. The VFD shall employ a full wave bridge rectifier and capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device.

D. The VFD package shall contain the equivalent of 5% impedance to reduce harmonic distortion. The 5% equivalent impedance shall be provided in the form of a DC bus choke, an input AC line reactor in each phase, or a combination of the two methods.

E. Control circuitry shall be plug-in, plug-out modular basis with a corrosion resistant coating on printed circuit boards.

F. Units to be suitable for an operating environment from 0°C to 40°C temperature and humidity up to 90% non-condensing.

G. Electrically and physically isolate control circuitry and conductors from power circuitry and power conductors. Control conductors and power conductors shall not be run in the same pathway.

H. The unit enclosure shall be NEMA 1, 3R or 12 as required for the application minimum and all components shall be fully factory assembled and tested prior to leaving the manufacturing facility.

I. Include the following operating and monitoring devices mounted on the front cover:
   1. A disconnect switch or circuit breaker to de-energize the drive with door interlocked handle and lock-open padlocking provisions.
   2. Operating mode selector switch marked "hand-off-auto".
   3. Manual speed adjustment via keypad, mounted on the door.

2.3 PERFORMANCE REQUIREMENTS

A. Units shall be suitable for input power of electrical system as scheduled on the drawings ±10%, 3 phase, 60 Hertz nominal.

B. Use a current limiting control device to limit output current to 110% continuous for one minute; also refer to Protection Features in this section. Full load output current available from drive shall not be less than motor nameplate amperage. The full load amp rating of the VFD shall not be less than the values indicated in the NEC Table 430-250.

C. Output power shall be suitable for driving standard NEMA B design, three phase alternating current induction motors at full rated speed with capability of 6:1 turndown.

D. Additional performance capabilities to include the following:
   1. Ride through a momentary power outage of 15 cycles.
   2. Start into a rotating load without damage to drive components or motor.
   3. Capable of automatic restart into a rotating load after a preset, adjustable time delay following a power outage.
   4. Input power factor: Min 0.95 throughout the speed range.
   5. Minimum efficiency: 95% at 100% speed, 85% at 50% speed.
   6. Adjustable thermal overload protection: Class 10.20.30.

2.4 CONTROL FEATURES

A. Use control circuits compatible with input signal from temperature control system in the automatic mode and from manual speed control in the manual mode. Vary motor speed in response to the input control signal. Include components necessary to accept the signal from the temperature control system in the form that it is sent. Refer to Division 23.

B. Include the following additional control features:
1. Hand-Off-Automatic (HOA) selector switch to select local or remote start/stop and speed control.
2. Analog input, selectable 0-10v or 4-20 mA, for automatic control from the temperature control system.
3. Local speed control at the VFD.
4. Adjustable acceleration and deceleration rate so that the time period from start to full speed and from full speed to stop can be field adjusted.
5. Adjustable minimum and maximum speed settings for both automatic and manual modes of operation.
6. Field adjustment of minimum and maximum output frequency.
7. Two (2) sets of programmable form “C” contacts for remote indication of variable frequency drive condition. Note: default programming to be set for “Drive Run & Fault”.
8. Illuminated display keypad.
9. External Fault indicator.
10. One (1) input for a N.O. dry contact type input for a 2-wire remote start/stop.
11. One (1) input for a N.C. dry contact type input for external faults: (freezestats, fire alarm, smokes, etc).
12. One (1) N.O. dry contact output for proving motor status. This output shall be programmed to detect belt or coupling break that would remove the load from the motor. The dry contact will open on loss of load or VFD being off.
13. PID control loop capable of VFD control from an external device connected to a VFD analog input.

C. The VFD controller shall convert VFD information into the BACnet MSTP / LonWorks FTT-10/ Other protocol that will be compatible with the building direct digital energy management system (EMS) supplied on the project. This output shall be through a serial interface port capable of two-way communication with the building EMS provided on this project. Final connection shall not require any additional intermediate gateway devices to provide throughput of data. The following data shall be provided at a minimum:
1. Fault condition.
2. Speed.
3. Amperage.
4. Frequency.
5. Voltage.

2.5 PROTECTION FEATURES

A. Use electronic protection circuitry in the power circuits to provide an orderly shutdown of the drive without blowing fuses or tripping circuit breakers and prevent component loss under the following abnormal conditions:
1. Activation of any safety device.
2. Instantaneous overcurrent and/or over voltage of output.
3. Power line overvoltage and undervoltage protection.
4. Phase loss.
5. Single and three phase short circuiting.
6. Ground faults.
7. Control circuit malfunction.
8. Overtemperature.
9. Output current over limit.

B. Provide the following additional protective features:
   1. Input transient overvoltage protection up to 3000 volts per ANSI 37.90A.
   2. DC bus fusing or other electronic controls which limit the rate of rise of the DC bus current and de-energizes the drive at a predetermined current level.
   3. Fusing for the control circuit transformer.
   4. Grounded control chassis.

2.6 DIAGNOSTICS

A. Provide an English character display (no error codes) with indicators for the following:
   1. Phase loss.
   2. Ground fault.
   3. Overcurrent.
   4. Overvoltage.
   5. Undervoltage.
   6. Over temperature.
   7. Overload.
   8. DC bus status.

2.7 QUALITY ASSURANCE TESTS

A. Use a factory heat stress test to verify proper operation of all functions and components under full load.

B. Field performance test of variable frequency drives to determine compliance with this specification will be performed at the Owner's discretion and may include any specified feature, including operation of protective devices through a simulated fault. Contractor will pay for initial testing. Should drive be found deficient by this testing, drive manufacturer will be required to make any and all changes necessary to bring unit(s) into compliance with the specified performance and demonstrate this performance by retesting. Cost of changes and retest will be by this Contractor.

C. Variable frequency drive manufacturer or designated representative to perform a field test of each drive, in the presence of the Owner's representative, for the following items:
   1. Provide general inspection to verify proper installation.
   2. Demonstrate drive reaction to simulated power interruptions of two seconds and sixty seconds.

2.8 AC INPUT LINE REACTORS

A. When needed to comply with the requirement for 5% equivalent impedance, furnish and factory install AC input line reactors.

B. Line reactors shall be installed in each phase of the AC input side of the VFD and mounted within a common enclosure with the VFD.

C. Line reactor shall be a three phase inductor, iron core, 600V, Class H insulation, 115 degree C rise, copper windings with screw type terminal blocks.

2.9 OUTPUT LINE FILTER

A. Provide a three phase dV/dT output filter for any 460VAC drive with output line length of over 120 feet or as specified.

PART 3 - EXECUTION

3.1 VARIABLE FREQUENCY DRIVES

A. Install where indicated on drawings and in accordance with approved submittals and manufacturer's published recommendations. Installation to be by the Division 26 Electrical Contractor.

B. Input power wiring shall be installed in a separate conduit, output power wiring shall be installed in a separate conduit and control wiring shall be installed in a separate conduit. Do not mix input power, output power, or control wiring in a common conduit. Separate conduits for input and output power wiring shall be provided for each motor. Input and output power wiring for more than one motor shall not share a common conduit. Power wiring shall be furnished and installed by the Div. 26 Contractor. If provided, do not mount output line filter above the drive.

C. Control signal for drive will be provided under Division 23.

D. Temperature Control Contractor will furnish and install the required temperature control wiring in metal conduit and in accordance with Division 26 Electrical of this specification.

3.2 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Description.
      g. Shop Drawings.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Pipe Hanger and Support Manufacturers.
      b. Structural Supports.
      c. Pipe Hangers and Supports.
      d. Wood Structure Supports.
      e. Beam Clamps.
      f. Concrete Inserts.
      g. Anchors.
      h. Roof Mounted Supports.
      i. Equipment Curbs.
      j. Pipe Penetrations through Roof.
      k. Corrosive Atmosphere Coatings.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Hanger and Support Spacing.
      c. Vertical Riser Clamps.
      d. Anchors.
      e. Roof Mounted Supports.
      f. Equipment Curbs.
      g. Pipe Penetration through Roof.

1.2 RELATED WORK

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 23 07 00 - HVAC Insulation.

1.3 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.4 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.

B. MSS SP-59 Pipe Hangers and Supports - Selection and Application.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 DESCRIPTION

A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

C. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

D. Protect insulation at all hanger points; see Related Work above.

1.7 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service. Reference section 23 05 00.

1.8 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Piping connected to base mounted pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

C. Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.

D. Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

E. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

F. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 - PRODUCTS

2.1 PIPE HANGER AND SUPPORT MANUFACTURERS

A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.2 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers For Steel Pipe Sizes 1/2” Through 2”:
   1. Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

B. Hangers For Steel Pipe Sizes 2-1/2” And Over:
   1. Carbon steel, adjustable, clevis, black finish. Anvil figure 260.

C. Adjustable steel yoke, cast iron roll, double hanger. Anvil figure 181.

D. Multiple or Trapeze Hangers:
   1. Steel channels with welded spacers and hanger rods if calculations are submitted.

E. Wall Support:
   1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
   2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

F. Vertical Riser Support:
   1. Carbon steel riser clamp, copper plated when used with copper pipe. Anvil figure 261 for steel pipe, figure CT121 for copper pipe.

G. Floor Support for Pipe Sizes through 4”:
   1. Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

H. Floor Support for Pipe Sizes 5” and Over:
   1. Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

I. Copper Pipe Support:
   1. Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

J. Insulation Protection Shields:
   1. Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

K. Steel Hanger Rods:
   1. Threaded both ends, threaded one end, or continuous threaded, black finish.
   2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
   3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8

4960	1
8000	1-1/4

4. Provide rods complete with adjusting and lock nuts.

2.4 WOOD STRUCTURE SUPPORTS

A. Carbon steel pipe short strap for piping 1/2" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.

B. Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.

C. Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum 1/2" x 3" lag screws. Anvil Figure 207

2.5 BEAM CLAMPS

A. MSS SP-69 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

2.6 CONCRETE INSERTS

A. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

2.7 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

2.8 ROOF MOUNTED SUPPORTS

A. Height of Supports:
1. Based on the length of the longest main support member, the height of the support member above the roof deck to be as follows:

Length of Longest Support Member (inches)	Min. Height of Support Above Finished Roof
Up to 36"	18 inches
37" and Over	36 inches

B. Supports 18" Or Less In Height:
1. Prefabricated Metal Sleeper Curb:
a. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing with metal receiver cap Attach a galvanized steel channel track for securing pipe or duct roller and roller support. Do not use built-in metal base flashings or cants.

2. Wood Build Sleeper Curb:
   a. Constructed of wood blocking anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing with metal receiver cap. Attach a steel channel track for securing pipe or duct roller support. Do not use built-in metal base flashings or cants.

C. Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section.

D. Supports 36” or More In Height:
1. Roof Support Stand/Equipment Roof Support Stand:
2. Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section.

2.9 EQUIPMENT CURBS

A. Prefabricated Metal Curb:
1. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18 inch high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

B. Wood Build Sleeper Curb:

1. Constructed of wood blocking and anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18 inch high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

2.10 PIPE PENETRATIONS THROUGH ROOF

A. Multiple Pipe Penetrations:
1. Refer to acceptable Equipment Curb types listed above for curb specifications. An 8” high (minimum) curb height is required. The coping cap shall be constructed from laminated acrylic clad thermoplastic (ABS) with graduated step boots to accommodate various size pipes, stainless steel fastening screws for cover, stainless steel band clamps for securing boots around the pipe, and stainless steel band clamp or mechanical locking seal for securing boots around the ABS coping cap flanges.

B. Single Pipe Penetrations:
1. A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes but is not limited to steam condensate vent piping, steam safety relief piping, and flues.
2. A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

2.11 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:
   1. Exterior locations.
   2. Food service/kitchen areas.
   3. Walk-in coolers/freezers.
   4. Locker/shower rooms.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

B. Piping shall be supported independently from ductwork and all other trades.

C. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

D. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

3.2 HANGER AND SUPPORT SPACING

A. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

C. Support riser piping independently of connected horizontal piping.

D. Adjust hangers to obtain the slope specified in the piping section of this specification.

E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Thermoplastic	All sizes	6'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

3.3 VERTICAL RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

3.4 ANCHORS

A. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.5 ROOF MOUNTED SUPPORTS

A. Use for all pipe and ductwork on roof. Secure bottom of support flat on roof deck. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counter flashing by the General Contractor.

3.6 EQUIPMENT CURBS

A. Secure bottom of support flat on roof deck. Secure equipment to curb in accordance with equipment manufacturer's instructions. Flashing and counter flashing by the General Contractor.

B. Fill the entire void space with compressible fiberglass insulation.

3.7 PIPE PENETRATION THROUGH ROOF

A. Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counter flashing by the General Contractor.

END OF SECTION

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SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for vibration isolation material for equipment, piping systems, and duct systems. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Quality Assurance.
      e. Design Criteria.
      f. Shop Drawings.
   2. PART 2 – PRODUCTS.
      a. Materials.
      b. Vibration Isolation Manufacturers.
      c. Type 2: Neoprene Pad.
      d. Type 3: Unhoused Spring with Neoprene.
      e. Type 4: Restrained Spring with Neoprene.
      f. Type 5: Spring Hanger with Neoprene.
      g. Type 6: Precompressed Spring Hanger with Neoprene.
      h. Type 7: Spring Hanger with Neoprene.
      i. Flexible Piping Connections.
      j. Performance.
      k. Blower Minimum Deflection Guide.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Packaged Air Handling Units and Centrifugal Fans.
      c. Isolation Devices Outdoors or in High Humidity Areas.

1.2 RELATED WORK

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 23 34 00 - HVAC Fans.

C. Section 23 33 00 - Air Duct Accessories.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.5 DESIGN CRITERIA

A. Isolate all motor driven mechanical equipment from the building structure and from the systems which they serve to prevent equipment vibrations from being transmitted to the structure. Consider equipment weight distribution to provide uniform isolator deflections.

B. For equipment with variable speed capability, select vibration isolation devices based on the lowest speed.

C. Provide flexible piping connections for all piping to rotating or reciprocating equipment mounted on vibration isolators except do not use flexible piping connectors on any type of gas piping or with inline pumps. Piping connected to a coil which is in an assembly mounted on vibration isolators is to have flexible piping connections and piping vibration hangers as specified below. Piping connected to a coil which is in an assembly where the fan is separately isolated by means of vibration isolators and duct flexible connections does not require flexible piping connectors or piping vibration hangers.

D. Credit will be given for the inherent flexibility and vibration absorption characteristics of mechanical grooved pipe connections providing that supporting calculations are submitted for approval.

E. Coordinate the selection of devices with the isolator and equipment manufacturers.

1.6 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include isolator type, materials of construction, isolator free and operating heights, and isolation efficiency based on the lowest operating speed of the equipment supported.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that will retain their isolation characteristics for the life of the equipment served. Use industrial grade neoprene for elastomeric materials.

B. Treat all isolators to resist corrosion. For isolation devices exposed to the weather or used in high humidity areas, hot dip galvanize steel parts, apply a neoprene coating on all steel parts, or use stainless steel parts; include limit stops to resist wind.

C. Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.

D. Use isolators with a ratio of lateral to vertical stiffness not less than 1.0 or greater than 2.0.

2.2 VIBRATION ISOLATOR MANUFACTURERS

A. Mason Industries, Amber/Booth Co., Vibration Mounting & Controls, Peabody Noise Control, Vibration Eliminator or approved equal.

2.3 TYPE 2: NEOPRENE PAD

A. Double deflection neoprene mount having a minimum static deflection of 0.35 inches. Cover all metal surfaces with neoprene to resist corrosion. Include friction pads on both top and bottom surfaces so mounts need not be bolted to the floor but include bolt holes for those areas where bolting is required. For equipment such as small vent sets and close coupled pumps, include steel rails for use between the isolator and the equipment to accommodate equipment overhang.

2.4 TYPE 3: UNHOUSED SPRING WITH NEOPRENE

A. Combination freestanding, unhoused spring and neoprene with rib molded antifriction base. Include leveling bolts for securing to the equipment. Springs to be laterally stable under load and selected so they have an additional travel to solid equal to 50% of the rated deflection. Use height saving brackets when appropriate to the application.

2.5 TYPE 4: RESTRAINED SPRING WITH NEOPRENE

A. Combination spring and neoprene with rib molded base similar to Type 3 mount above, but with a housing that includes vertical limit stops to prevent spring extension when weight is removed such that the installed and operating heights are the same. Maintain a minimum clearance of 1/2 inch around restraining bolts, and between the housing and the spring, so as not to interfere with the spring action. Design isolator so limit stops are out of contact during normal operation. Use height saving brackets when appropriate to the application.

2.6 TYPE 5: SPRING HANGER WITH NEOPRENE

A. Vibration hanger with a steel spring and 0.3 inch deflection neoprene element in series. Use neoprene element molded with a rod isolation bushing that passes through the hanger box. Select spring diameters and size hanger box lower holes large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Select springs so they have a minimum additional travel to solid equal to 50% of the rated deflection.

2.7 TYPE 6: PRECOMPRESSED SPRING HANGER WITH NEOPRENE

A. Vibration hanger similar to Type 5 but precompressed to the rated deflection to keep the piping or equipment at a fixed elevation during installation. Design hanger with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load.

2.8 TYPE 7: SPRING HANGER WITH NEOPRENE

A. Steel spring hanger located in a neoprene cup manufactured with a grommet to prevent short circuiting of the hanger rod. Neoprene cup to contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Design spring diameter and size hanger box lower hole sufficiently large to permit the hanger rod to swing through a 30° arc before contacting the hole perimeter and short circuiting the spring. Select spring so it has a minimum additional travel to solid equal to 50% of the rated deflection. Provide hanger with an eye bolt on the spring end and provision to attach the housing to the flat iron duct straps.

2.9 FLEXIBLE PIPING CONNECTIONS

A. Suitable for pressure, temperature, and fluid involved; minimum pressure rating for any system is 125 psig at the design temperature of the fluid. Use 12 inch minimum line length of flexible hose or length required to absorb 3/4 inch lateral movement, whichever is greater.

B. Manufacturers:
   1. Flexonics, Mason, Mercer Rubber, Metraflex, Engineered Flexible Products or approved equal.

C. Water:
1. Multiple plies of nylon tire cord fabric reinforced with an EPDM cover and liner. Do not use steel wire or rings as pressure reinforcement. Use threaded or soldered connections for sizes 2 inch and smaller and floating steel or ductile iron flanges for sizes 2-1/2 inch and larger; design the steel flange end so the steel flange is recessed to lock a steel wire bead ring in the raised face of the EPDM flange. Construct straight-through connections with twin spheres. Use control rods when recommended by the manufacturer.

D. Refrigerant:
1. Seamless bronze corrugated flexible hose with bronze wire braided cover and solder type copper tube ends with the entire assembly fabricated specifically for refrigerant duty.

2.10 PERFORMANCE

A. Select vibration isolation devices as indicated below or to provide not less than 95% isolation efficiency, whichever is greater.

	---------- Floor Span or Column Spacing----------							
	--On Grade--		---20 Feet---		---30 Feet---		---40 Feet---	
TYPE OF EQUIPMENT	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.
REFRIGERATION MACHINES:								
Reciprocating								
To 750 rpm	4	0.75	4	1.50	4-S	1.50	4-S	2.50
751 rpm and over	4	0.75	4	0.75	4-S	1.50	4-S	2.50
PUMPS:								
Base Mounted								
Close Coupled								
Thru 5 hp	Bolt to pad		3-IB	0.75	3-IB	0.75	3-IB	0.75
7-1/2 hp and over	Bolt to pad		3-IB	0.75	3-IB	1.50	3-IB	1.50
AIR-COOLED CONDENSER:	Bolt to pad		3	0.75	3	1.50	3	2.50
PACKAGED AIR HANDLING UNITS:								
Floor mounted								
Thru 5 hp	3	0.35	3	0.75	3	0.75	3	0.75
7-1/2 hp and over								
Thru 400 rpm	3	0.35	3-S	1.50	3-S	1.50	3-S	1.50
7-1/2 hp thru 40 hp								
401 rpm and over	3	0.35	3	0.75	3	0.75	3-S	1.50
50 hp and larger								
401 rpm and over	3	0.35	3	0.75	3-S	1.50	3-S	2.50
CENTRIFUGAL BLOWERS								
Floor mounted	Use type 3-IB mount with deflection from blower minimum deflection guide.							

CABINET FANS AND FAN SECTIONS OF AIR HANDLING UNITS:

Floor mounted — Type 2-T for 0.35" deflection, type 3-T for 0.75" deflections and type 3-S-T for deflections over 0.75" with deflection from blower minimum deflection guide.

PIPING CONNECTED TO ROTATING OR RECIPROCATING EQUIPMENT: Flexible piping connections and type 5 or 6 hangers for a distance of 100 pipe diameters or a distance of three hangers away from the equipment, whichever is greater. Type 6 hangers shall be utilized for the first two upstream and downstream hangers. The Type 5 and/or type 6 hangers must have the same deflection as the hangers supporting the rotating or reciprocating equipment. Where piping is floor supported, the above requirements apply, but use type 3 mounts instead of type 5 or 6 hangers.

DUCTWORK IN MECHANICAL EQUIPMENT ROOMS: Use type 7 hanger with .75" minimum deflection for all ducts with a cross sectional area greater than 2.0 square feet and, where either the air velocity is greater than 3500 fpm or, the pressure class is 4" water column or higher.

BLOWER MINIMUM DEFLECTION GUIDE

	Required Deflection (Inches)			
Fan Speed (RPM)	On Grade	20' Floor Span	30' Floor Span	40' Floor Span
175-224	0.35	3.50	4.50	4.50
225-299	0.35	3.50	3.50	3.50
300-374	0.35	2.50	2.50	3.50
375-499	0.35	1.50	2.50	3.50
500 and over	0.35	0.75	1.50	2.50

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vibration isolation devices for motor driven equipment in accordance with the manufacturer's installation instructions.

B. Set steel and inertia bases for one inch clearance between the concrete floor or housekeeping pad and the base.

C. Do not allow installation practices to short circuit any isolation device.

D. Install flexible piping connections on the equipment side of shut-off valves.

3.2 PACKAGED AIR HANDLING UNITS AND CENTRIFUGAL FANS

A. Attach horizontal thrust restraints at the centerline of thrust and symmetrically on either side of the unit. Thrust restraints are not required when the fan section in not isolated from the remainder of the air handling unit by means of duct flexible connections.

3.3 ISOLATION DEVICES OUTDOORS OR IN HIGH HUMIDITY AREAS

A. Use only hot dip galvanized, stainless steel, or neoprene coated steel parts.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Description.
      f. Quality Assurance.
      g. Pre-Balance Conference.
      h. Submittals.
   2. PART 2 – PRODUCTS.
      a. Instrumentation.
   3. PART 3 – EXECUTION.
      a. Daily Reports.
      b. Preliminary Procedures.
      c. Performing Testing, Adjusting and Balancing.
      d. VAV Supply Duct System Static Pressure Set Point.
      e. Hydronic System Differential Pressure Control Set Point.
      f. Deficiencies.

1.2 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC.

B. Section 23 07 00 - HVAC Insulation.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

D. Section 23 09 23 - Direct Digital Control System for HVAC.

1.3 REFERENCE

A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. AABC National Standards for Total System Balance, Sixth Edition, 2002.

B. ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.

C. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

1.5 DESCRIPTION

A. The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical Contractor is specified in other section of these specifications.

B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.

C. Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
2. A certified member of AABC, TABBorNEBB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact Owner immediately.
3. Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity.
4. Submit Qualifications of firm and project staff to Owner upon request.

1.7 PRE-BALANCE CONFERENCE

A. 90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the Engineer, Owner's Project Representative and the mechanical system and temperature control system installing Contractors. Provide Engineer and Commissioning Provider (CxP) with a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

1.8 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures. See also Related Work in this section.

B. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

C. Submission:
   1. Distribute electronic copies of the Report to the Contractor, the Lead Contractor, the Owner, and the Prime Engineer.

D. Enter an RFI, with a copy of the Testing and Balancing Report Summary as an upload, indicating that the Testing and Balancing Report is posted on the Overview page and requesting review of the report.
   1. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
      a. General Information.
      b. Summary.
      c. Air Systems.
      d. Hydronic Systems.
   2. Contents: Provide the following minimum information, forms and data:
      a. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.
      b. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.
      c. The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 - PRODUCTS

2.1 INSTRUMENTATION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by Owner upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards

PART 3 - EXECUTION

3.1 DAILY REPORTS

A. Submit to Owner's Project Representative daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

3.2 PRELIMINARY PROCEDURES

A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

B. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

C. Notify Owner's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.3 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

B. Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.

C. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the Owner's Project Representative.

D. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

E. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

F. Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

H. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

I. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

J. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the Owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to Owner's project representative. Prior authorization is needed before this work is started.

K. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

L. Final air system measurements to be within the following range of specified cfm:
1. Fans 0% to +10%.
2. Supply grilles, registers, diffusers 0% to +10%.
3. Return/exhaust grilles, registers 0% to -10%.

M. Final water system measurements must be within the following range of specified gpm:
1. Heating flow rates 0% to -10%.
2. Cooling flow rates -5% to +5%.

N. Contact the temperature control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

O. Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

P. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

Q. Verify and record, in the T&B Report, “K” factors for all VAV air terminal devices and air flow stations.

R. Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

3.4 VAV SUPPLY DUCT SYSTEM STATIC PRESSURE SET POINT

A. For VAV supply and exhaust systems with VAV air terminal devices, determine the minimum required duct static pressure at the DDC static pressure sensor location(s) needed to ensure that all VAV air terminals are operating at their design airflows with the most demanding VAV terminal wide open. Provide these static pressure numbers to the DDC temperature controls contractor and record them in the T&B report for each system.

3.5 HYDRONIC SYSTEM DIFFERENTIAL PRESSURE CONTROL SET POINT

A. For hydronic systems with variable speed pumping, determine the minimum required system differential pressure set point needed to ensure that all terminal devices are operating at their design water flows with the most demanding terminals device control valve wide open. Provide the differential control setting set point to the DDC temperature control contractor and record them in the T&B report for each system.

B. For HVAC pumps 10 horsepower or less, valve throttling alone may be used for hydronic system balancing.

C. Throttling of triple-duty valves shall not exceed 50% closed. Where additional throttling would be necessary to achieve the system design flow the impellor shall be trimmed.

D. Verify Triple duty valve utilized on systems with Variable Frequency Drives are 100% open when balancing work is complete.

E. The pressure drop across triple duty valves shall not exceed 25 ft. w.g. Where additional throttling would be necessary to achieve the system design flow the impellor shall be trimmed.

F. For HVAC pumps greater than 10 horsepower through 60 horsepower, trim the impellor where valve throttling will result in a draw that exceeds 3 horsepower.

G. Future fouling of an open piping system may be considered when determining impellor trim requirements.

H. Verify butterfly valves utilized for hydronic system balancing are provided with position-lock operators (memory stops). The adjustment and marking of lever-lock operators that use throttling notches will not be accepted. Lock all memory stops so the valves can be reopened to their balanced positions if they are used for isolation purposes.

3.6 DEFICIENCIES

A. Division 23 Contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner's Project Representative of these items and instructions will be issued to the Division 23 Contractor for correction of the deficient work. All corrective work to be done at no cost to the Owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SCOPE

A. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Description.
      g. Definitions.
      h. Shop Drawings.
      i. Operation and Maintenance Data.
      j. Environmental Requirements.
   2. PART 2 – PRODUCTS.
      a. Materials.
      b. Insulation Types.
      c. Jackets.
      d. Insulation Inserts and Pipe Shields.
      e. Expansion Joint and Valve Insulation Blankets.
      f. Accessories.
   3. PART 3 – EXECUTION.
      a. Examination.
      b. Installation.
      c. Protective Jacket Installation.
      d. Piping, Valve and Fitting Insulation.
      e. Piping Protective Jackets.
      f. Pipe Insulation Schedule.
      g. Duct Insulation.
      h. Ductwork Protective Coverings.
      i. Duct Insulation Schedule.
      j. Equipment Insulation.
      k. Equipment Insulation Schedule.

1.2 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC.

B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

C. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate.

B.	ASTM C165	Test Method for Compressive Properties of Thermal Insulations.
C.	ASTM C177	Heat Flux and Thermal Transmission Properties.
D.	ASTM C195	Mineral Fiber Thermal Insulation Cement.
E.	ASTM C240	Cellular Glass Insulation Block.
F.	ASTM C302	Density of Preformed Pipe Insulation.
G.	ASTM C303	Density of Preformed Block Insulation.
H.	ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials.
I.	ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement.
J.	ASTM C518	Heat Flux and Thermal Transmission Properties.
K.	ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation.
L.	ASTM C534	Preformed Flexible Elastomeric Thermal Insulation.
M.	ASTM C547	Mineral Fiber Preformed Pipe Insulation.
N.	ASTM C552	Cellular Glass Block and Pipe Thermal Insulation.
O.	ASTM C553	Mineral Fiber Blanket and Felt Insulation.
P.	ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation.
Q.	ASTM C591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
R.	ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation.
S.	ASTM C612	Mineral Fiber Block and Board Thermal Insulation.
T.	ASTM C921	Properties of Jacketing Materials for Thermal Insulation.
U.	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation.
V.	ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.
W.	ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications.
X.	ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
Y.	ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics.
Z.	ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics.
AA.	ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
BB.	ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness.
CC.	ASTM E84	Surface Burning Characteristics of Building Materials.
DD.	ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems.
EE.	ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
FF.	MICA	National Commercial & Industrial Insulation Standards.
GG.	NFPA 225	Surface Burning Characteristics of Building Materials.
HH.	UL 723	Surface Burning Characteristics of Building Materials.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

C. Insulation systems shall be applied by experienced Contractors. Within the past five (5) years, the Contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

1.6 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation.
   2. Duct Insulation.
   3. Equipment Insulation.

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner Project Representative.

1.7 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.8 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.9 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

B. Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Armacell: www.armacell.com.
   2. Certainteed: www.certainteed.com.

3. Manson: www.imanson.com.
4. Fibrex: www.fibrexinsulations.com.
5. H.B. Fuller: www.hbfuller.com.
6. Imcoa: www.nomaco.com.
7. Johns Manville: www.johnsmanville.com.
8. Knauf: www.knaufusa.com.
9. Owens-Corning: www.insulation.owens-corning.com.
10. Rubatex: www.rubatex.com.
11. VentureTape: www.venturetape.com.
12. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Materials or accessories containing asbestos will not be accepted.

C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:
1. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when tested in accordance with UL 723 and ASTM E84.

2.2 INSULATION TYPES

A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

B. Flexible Fiberglass Insulation:
1. Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

C. Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
2. White paper encapsulated reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

D. Semi-Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.
2. White paper encapsulated reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

E. Elastomeric Insulation:
1. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

F. Extruded Polystyrene Insulation:
1. Rigid closed cell, minimum nominal density of 1.6 lbs. per cu. ft., thermal conductivity of not more than 0.285 at 75 degrees F, minimum compressive strength of 20 psi, maximum water vapor permeability of 1.5 perm inch, maximum water absorption of .5 % by volume, rated for service range of -290 degrees F to 165 degrees F.

G. Polyisocyanurate Insulation:
1. Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 psi parallel and 13 psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.

H. Fireproofing Insulation:
1. Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 25, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F, rated for service of -120 degrees F to 1200 degrees F. Use rigid or semi-rigid board for duct insulations.

I. Foil-scrim-polyethylene vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms.

J. Fire-Stop Insulation:
1. Noncombustible, non-asbestos, non-ceramic fiber, high temperature blanket or board fireproofing insulation, constructed of calcium silicate or calcium/magnesium/silica amorphous wool with 2-hour ASTM E814 “F” and “T” fire ratings, UL or equivalent third party listed, labeled and specifically evaluated for such purpose in accordance with ASTM E2336. Foil-scrim-polyethylene fiberglass reinforced factory applied jacket.

2.3 JACKETS

A. PVC FITTING COVERS AND JACKETS (PFJ):
1. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum .02” indoors/.03”outdoors for piping 12 inches and smaller, .03” indoors/.04” outdoors for piping 15 inches and larger.

B. All Service Jackets (ASJ):
1. Heavy duty, fire retardant material with white kraft reinforced foil vapor barrier, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

C. Foil Scrim All Service Jackets (FSJ, also known as FRK or FSK):
1. Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

D. Self-Adhering Jackets (SAJ):
1. 5-ply, self-adhering multiple laminated waterproofing material with reflective aluminum foil, high density polymer films and cold weather acrylic adhesive providing zero (0.0) permeability. Minimum 6 mils material thickness, 35lb puncture resistance when tested in accordance with ASTM D1000 and flame spread/smoke developed rating of 10/20 when tested in accordance with UL 723.
2. Vapor retarding tape shall be specifically designed and manufactured for use with the self-adhering jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with self-adhering jackets shall have a maximum permeance of 0.0 perms.

E. Fabric Reinforced Mastic Jackets (FMJ):
1. Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer’s recommended procedure for 2 coat application.

F. Vapor Retarding Jackets (VRJ):
1. Polyvinylidene chloride (PVDC) vapor retarding jacket material with minimum 6 mils material thickness and maximum permeance of 0.01 perms. Material shall not support the growth of mold or mildew. Dow Saran or equivalent.
2. Vapor retarding tape shall be specifically designed and manufactured for use with the vapor retarding jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with vapor retarding jackets shall have a maximum permeance of 0.01 perms.

2.4 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products.

B. Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300 degrees F only), minimum 140 psi compressive strength. Piping 12 inches and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where Contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered/pre-manufactured product described above. On low temperature systems, high density rigid polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge are increased to compensate for lower insulation compressive strength.

D. Pre-compressed 18# density molded fiberglass blocks, ICA or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1”x6” block for piping through 2-1/2 inch and three 1” x 6” blocks for piping through 4 inch. Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

E. Wood blocks will not be accepted.

2.5 EXPANSION JOINT AND VALVE INSULATION BLANKETS

A. Manufacturers: Advance Thermal Corporation, TANI Division B.D. Schiffler or approved equal.

B. Jacket shall be 7 ounce per square yard Teflon coated Nomex fabric which is designed for wet and dry steam applications to 550ºF. Equal to Advance Thermal Corp. Steamguard-1 cloth. The covers shall be installed to shed water and have a 1-inch rain flap.

C. All seams shall be sewn twice with double locked stitching. One seam shall be sewn with 3-ply Nomex and the other with 3-ply stainless steel. Hog rings and staples shall not be used.

D. The insulation shall be a 2-inch thick, 6 lb. density ceramic fiber which is held in place with 12 gauge stainless quilt pins which do not puncture the inner surface of the cover.

E. Covers shall be designed to allow access to the expansion and ball joints packing cylinder plungers for repacking with removing the covers.

F. Adjacent pipe insulation must be installed to allow the piping to expand into expansion joints without damaging the insulation or removable covers.

2.6 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.

K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.2 INSTALLATION

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.

G. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

H. Provide a complete vapor barrier for insulation on the following systems:
1. Cold Water Make-Up.
2. Chilled Water.
3. Refrigerant.

4. Insulated Duct.
5. Equipment, ductwork or piping with a surface temperature below 65 degrees F.

3.3 PROTECTIVE JACKET INSTALLATION

A. Self-Adhering Jackets (SAJ):
   1. Install according to manufacturer's recommendations. Cut allowing minimum 4 inch overlap on ends and 6 inch on longitudinal joints. Align parallel to surface. Remove release paper and press flat to surface to avoid wrinkles. Rub entire surface for full adhesion and sealing at joint overlaps. On exterior applications, provide a bead of compatible caulk along exposed edges.
   2. Piping with self-adhering (SAJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the self-adhering (SAJ) jacket may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

B. Vapor Retarding Jackets (VRJ):
   1. Piping with vapor retarding (VRJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the vapor retarding (VRJ) jackets may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

C. PVC Fitting Covers and Jackets (PFJ):
   1. Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4 inches without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor barrier, apply a 1-1/2 inch band of mastic over ends, throat, seams and penetrations.

D. Fabric Reinforced Mastic Jackets (FMJ):
   1. Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating in accordance with manufacturer's recommendations. All seams shall overlap not less than 2 inches.

3.4 PIPING, VALVE, AND FITTING INSULATION

A. General:
   1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2 inch lap on jacket seams and 2 inch tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally secure with staples along seams and butt joints. Coat staples, longitudinal and transverse seams with vapor barrier mastic on systems requiring vapor barrier.
   2. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

3. Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.
4. Fully insulate all reheat coil piping, fittings and valves (with the exception of unions) up to coil connection to prevent condensation when coil is inactive during cooling season. Provide a vapor proof seal between the pipe insulation and the insulated coil casing.

B. Insulation Inserts and Pipe Shields:
1. Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions; however the inserts shall be no less than 12 inches in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.
2. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4 inch and smaller copper piping provided 12 inch long 22 gauge pipe shields are used.

C. Fittings and Valves:
1. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

D. Closed Cell Elastomeric Thermal Insulation:
1. Flexible closed cell, thermal conductivity 0.245, water vapor transmission of 0.03 perm inch, UV resistance minimal change ASTM G 7 and ASTM G 90, fire rating will not contribute significantly to fire (simulated end-use testing), recommended service temperature range is -297 degrees F to 257 degrees, designed for installation above and below ground.
2. Flame spread rating of 25 or less and a smoke developed rating of 50 or less as tested by ASTM E 84 "Surface Burning Characteristics of Building Materials".
3. Two step sealing system to insure a permanent seal. Step 1 an acrylic adhesive seam seal on the inside of the longitudinal joint. Step 2 EPDM flap that utilizes a cellular fusion adhesive that closes across the top of the longitudinal seam. This adhesive chemistry bonds the EPDM to the tube ensuring a seal for the life of the system. Butt joints and other seams are to be sealed with contact adhesive. Fittings can be fabricated from straight tubing or sheet. Larger diameter, curved, or flat surfaces can be insulated by adhering properly fabricated sheet sections to them.

E. Elastomeric and Polyolefin:
1. Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyeolefin, seal factory pre-glued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces. Cover elastomeric insulation on systems operating below 40 degrees F with vapor barrier mastic.

F. Extruded Polystyrene and Polyisocyanurate:
1. Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded insulation of the same thickness as adjoining insulation. Secure insulation sections with two wraps of nylon filament tape 9"-12" on center. On single insulation layer systems and on the outer layer of double insulation layer systems, apply a thin coat of elastomeric joint sealant rated for system operating temperatures to all longitudinal and butt insulation joints covering entire face of joint. Allow sealant to fully cure before

applying protective covering. For piping service below 0°F, use two layers of insulation with inner and outer butt and longitudinal joints staggered and offset 90 degrees. Where two layers of insulation are used, do not use sealant on the inner layer or adhere the inner layer to the outer layer. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, thermometers/gauges, attached vent and drain lines. Insulate attached non-circulated lines, control lines, vents, etc. for a minimum distance of 6 inches from pipe. Cover insulation with a protective jacket as specified below. Do not penetrate protective covering or insulation with mechanical fasteners.

3.5 PIPING PROTECTIVE JACKETS

A. In addition to the jackets specified in the pipe insulation schedule below, the following protective jackets are required:
   1. Provide a protective PVC jacket (PFJ) for the following insulated piping:
      a. Chilled water piping and valves in walk-thru tunnels and valve pits.
      b. Exposed piping in kitchens.
      c. Piping exposed in finished locations.
   2. Provide a protective PVC (PFJ) or Fabric Reinforced Mastic (FMJ) jacket for the following insulated piping:
      a. All piping within mechanical rooms.
      b. All piping within 8 feet of the mechanical room floor, or in areas determined to be susceptible to damage.
   3. Provide a protective covering of 2 coats of vapor barrier mastic with fibrous glass or canvas fabric reinforcing (FMJ) for the following insulated piping.
   4. Provide a protective self-adhering (SAJ) jacket for the following insulated piping.

3.6 PIPE INSULATION SCHEDULE

A. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation**	**Jacket**	**Insulation Thickness By Pipe Size**				
			≤ 1-1/4”	**1-1/2”**	**2” to < 4”**	**4” to 6”**	**8” and Larger**
Heating Hot Water	Rigid Fiberglass	ASJ	1.5”	1.5”	2”	2”	2”
Note: On 1” or smaller hot water pipe runouts to terminal unit coils the insulation thickness may be reduced to 1/2" on both the supply and return pipes within 4ft of the coil but not on the distribution system side of the temperature control valve.							
Chilled Water	Polyiso./Polysty.	VRJ or SAJ	1.5”	1.5”	1.5”	1.5”	1.5”
Refrigerant Suction:							
>40°F	Elast./Polyol	None	0.5”	1”	1.5”	1.5”	1.5”
40°F to 20°F	Elast./Polyol	None	1”	1.5”	1.5”	1.5”	1.5”
20°F to -20°F	Ext Poly/Polyiso	VRJ or SAJ	1.5”	2”	2”	2”	2.5”
-20°F to -60°F	Ext Poly/Polyiso	VRJ or SAJ	2”	2”	2.5”	2.5”	3”

Cold Water Piping	Rigid Fiberglass	ASJ	0.5”	0.5”	1”	1”	1”
Cooling Coil	Rigid Fiberglass	ASJ	0.5”	0.5”	1”	1”	1”

B. The following piping and fittings are not to be insulated:
   1. Hot water piping inside radiation, convector, or cabinet heater enclosures.
   2. Piping unions for systems not requiring a vapor barrier.

C. For systems with fluid temperatures 65° F or less, furnish and install removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices that require access by balancing Contractors or service and maintenance personnel. Examples include but are not limited to: flow sensing devices, circuit setters, manual ball valve air vents, drain valves, blowdown valves, pressure/temperature test plugs, grease fittings, pump bearing caps, equipment labels, etc. Covers shall be tight fitting to ensure a complete vapor barrier.

3.7 DUCT INSULATION

A. General:
   1. Secure flexible duct insulation on sides and bottom of ductwork over 24 inch wide and all rigid duct insulation with weld pins. Space fasteners 18 inch on center or less as required to prevent sagging.
   2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3 inches from each edge and spaced no greater than 12 inch on center.
   3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4 inch tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.
   4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
   5. External supply duct insulation is not required where ductwork contains continuous 1 inch acoustical liner. Provide 4 inch overlap of external insulation over ends of acoustically lined sections.
   6. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.
   7. Where insulated low temperature (below 45ºF) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.
   8. Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor barrier jacketing to encapsulate the support channels.
   9. Where ductwork exposed to the weather is insulated with any product other than fluid-applied ductwork insulation, the top surface of the insulation shall be sloped a minimum of 1/4 inch per foot to eliminate ponding and create positive drainage off of insulation. Refer to fluid-applied ductwork insulation section below for slope requirements.

B. Grease Ducts:
   1. Strictly adhere to manufacturer’s installation instructions and rating requirements for application of fire-stop insulation. Cover all exhaust ducts serving Type I kitchen hoods with fire-stop insulation from a point prior to penetration of ceiling, wall, floor or concealment through building to termination at outside of building. Extend fire-stop insulation through roof curbs.

3.8 DUCTWORK PROTECTIVE COVERINGS

A. In addition to the jackets specified in the duct insulation schedule below the following protective coverings are required:

B. Provide a protective covering of 2 coats of indoor/outdoor vapor barrier mastic with fibrous glass or canvas fabric covering (FMJ) for the following ductwork:
   1. Ductwork within 10’ of floor, catwalks and mezzanines in mechanical rooms.

C. Provide a protective self-adhering jacket (SAJ) for the following insulated ductwork:

3.9 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Rigid Fiberglass	FSJ	3”
Mixed air ducts	Rigid Fiberglass	FSJ	3”
Exposed supply ducts*	Rigid Fiberglass	FSJ	2”
Concealed supply ducts	Flexible Fiberglass	FSJ	1-1/2”
All Ducts located in unconditioned Attics***	Flexible Fiberglass	FSJ	3”
Exhaust & relief ducts downstream of motorized back-draft dampers	Rigid Fiberglass	FSJ	2”
All ducts exposed to weather	Rigid Fiberglass	SAJ	3”
Grease ducts serving Type 1 Kitchen hoods	Fire-Stop	See Spec.	As Required for Specified Hourly Rating

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

*** Outside air ductwork between the isolation damper and the outside air intake does not require insulation where it is located in an unheated attic.

3.10 EQUIPMENT INSULATION

A. General:
   1. Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

B. Semi-Rigid Fiberglass:
   1. Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic (FMJ). Use vapor barrier mastic on systems requiring a vapor barrier.

C. Elastomeric/Polyolefin:
   1. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

D. Removable Covers:
   1. Provide insulated easily removable galvanized steel metal boxes for routine service access on the following equipment:

E. Provide insulated easily removable elastomeric insulation sections for the following equipment:

3.11 EQUIPMENT INSULATION SCHEDULE

A. Provide equipment insulation as follows:

Equipment	Insulation	Jacket	Thickness Type
Reheat coil casing in exposed supply ducts	Rigid Fiberglass	FSJ	2”
Reheat coil casing in concealed supply ducts	Flexible Fiberglass	FSJ	1-1/2”
Hot Water Air separators	Semi-Rigid Fiberglass	ASJ	1.5”
Chilled Water Air separators	Elastomeric/Polyolefin	None	1”
Chilled water compression tanks	Elastomeric/Polyolefin	None	1”
Chilled Water Storage tanks	Semi-Rigid Fiberglass	ASJ	2”
Chilled Water Pumps	Elastomeric/Polyolefin	None	1”
Air Handling Unit Casings or attached component sections not factory insulated**	Rigid Fiberglass	ASJ	2”

* Condenser shell only needs to be insulated when condenser is city, lake, or river water cooled or when "free cooling" is used.

** The thickness and type of insulation provided for non-factory fabricated transitions or component sections shall be consistent with the sections constructed at the factory.

*** Protective metal jacket (PMJ) is only required in exposed locations.

END OF SECTION

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SECTION 23 09 13 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. This section includes the end devices required for stand-alone control and / or the components required for a fully functional DDC control system specified in Section 23 09 23. Included in this section are the following topics:

1. PART 1 – GENERAL.
    a. Scope.
    b. Related Work.
    c. Reference.
    d. Work Not Included.
    e. Quality Assurance.
    f. Reference Standards.
    g. System Description.
    h. Submittals.
    i. Design Criteria.
    j. Operation and Maintenance Data.
    k. Warranty.
    l. Material Delivery and Storage.
2. PART 2 – PRODUCTS.
    a. Manufacturers.
    b. Control Dampers.
    c. Smoke and Combination Fire / Smoke Dampers.
    d. Duct Smoke Detector and Fire Alarm Interface Modules.
    e. Control Valves.
    f. Control System Instrumentation.
    g. Electric/Electronic Thermostats.
    h. Temperature Control Panels.
    i. Air Flow Stations.
    j. Water Flow Measurement.
    k. Temperature Sensors.
    l. Humidity Sensors.
    m. Air Pressure Transducers.
    n. Liquid Pressure Transducers.
    o. Air Differential Pressure Switches.
    p. Liquid Differential Pressure Switches.
    q. Flow Switches.
    r. Current Status Switches.
    s. Current Transducer.
    t. Carbon Dioxide (CO2) Sensor.
    u. Power Supplies.
3. PART 3 – EXECUTION.
    a. Installation.
    b. Control, Combination Fire/Smoke, and Smoke Dampers.
    c. Control Valves.
    d. Control System Instrumentation.
    e. Electric/Electronic Room Thermostats.
    f. Temperature Control Panels.
    g. Low Limit Thermostats.

h. Air Flow Stations.
i. Liquid Flow Sensors.
j. Room Sensors.
k. Air and Water Pressure Transducers.
l. Air and Liquid Differential Pressure Switches.
m. Water Flow Switches.
n. Current Status Switches.
o. Carbon Dioxide Sensors.
p. Owner Training.

1.2 RELATED WORK

A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination.

B. Input / Output Summary - See project drawings.

C. Section 23 09 23 - Direct Digital Control System for HVAC.

D. Section 23 09 93 - Sequence of Operation for HVAC Controls.

E. Section 23 33 00 - Air Duct Accessories - for control damper installation.

F. Division 23 - HVAC - Equipment provided to be controlled or monitored.

G. Division 26 - Electrical - Installation requirements & Equipment provided to be controlled or monitored.

H. Division 28 - Electronic Safety and Security.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 WORK NOT INCLUDED

A. Direct digital controls and energy management interface, as specified in Section 23 09 23.

1.5 QUALITY ASSURANCE

A. Installing Contractor must be a manufacturer's branch office or an authorized representative of the control equipment manufacturer that provides engineering and commissioning of the manufacturers control equipment, submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing Contractor has successfully completed all necessary training required for engineering, installation, and commissioning of equipment and systems to be provided for the project, and that such authorization has been in effect for a period of not less than three years.

1.6 REFERENCE STANDARDS

A. ANSI B16.22 - Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.

B. ANSI/ASTM B32 - Specification for Solder Metal.

C. ASTM B75 - Seamless Copper Tube.

D. ASTM D1693 - Environmental Stress-Cracking of Ethylene Plastics.

E. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

F. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

G. AMCA 500-D - Laboratory Method of Testing Dampers for Rating.

1.7 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include the following information:

1. Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.
2. Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not acceptable.
3. Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Also include on drawings location of mechanical equipment controlled (room number), horsepower and flow of motorized equipment (when this data is available on plans), locations of all remote sensors and control devices (either by room number or column lines).
4. Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.
5. Schedule of control valves indicating system in which the device is to be used, rated capacity, flow coefficient, flow required by device served, actual pressure drop at design flow, size of operator required, close-off pressure, and locations where valves are to be installed.
6. A complete description of each control sequence for equipment that is not controlled by direct digital controls. Direct digital controlled equipment control sequences will be provided by the DDC Control Contractor.
7. Calculations completed to determine size of control air compressor(s) and dryer (s).
8. Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.
9. Provide a complete set of Submittal Drawings to the 23 09 23 DDC Contractor to enable them to coordinate the interfacing of the 23 09 13 controls with the DDC controls. The 23 09 23 Contractor is also required to provide any information regarding their supplied control equipment to the 23 09 13 Contractor so that the 23 09 13 Contractor can complete their engineered Submittal Drawings.
10. Provide a complete set of Record Drawings to the 23 09 23 Contractor to enable them to provide a complete composite set of drawings incorporating DDC and electric controls as specified.

1.8 DESIGN CRITERIA

A. Size all control apparatus to properly supply and/or operate and control the apparatus served.

B. When devices are identical the product shall be from one manufacturer.

C. Provide control devices subject to corrosive environments with corrosion protection or construct them so they are suitable for use in such an environment.

D. Provide devices exposed to outside ambient conditions with weather protection or construct them so they are suitable for outdoor installation.

E. Provide all required components not specifically indicated or specified but necessary for a completely functioning system.

F. Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

1.9 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.10 WARRANTY

A. Provide a 1 year on all materials and workmanship.

1.11 MATERIAL DELIVERY AND STORAGE

A. Provide factory shipping cartons for each piece of equipment and control device. This Contractor is responsible for storage of equipment and materials inside and protected from the weather.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Johnson Controls, Inc.: www.johnsoncontrols.com.

B. Honeywell: www.honeywell.com.

C. Siemens: www.siemens.com.

D. Invensys: www.invensys.com.

E. Trane: www.trane.com.

F. Kreuter: www.kreuter.com.

G. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 CONTROL DAMPERS

A. Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal or greater than the ductwork pressure class as specified in Section 23 31 00 of the ductwork where the damper is installed.

B. Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.

C. All dampers in stainless steel, PCD coated steel, PVC, PTFE, or fiberglass ductwork shall be constructed of stainless steel.

D. All dampers in aluminum ductwork shall be constructed of stainless steel or aluminum.

E. Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

F. All dampers, unless otherwise specified, to be rated at a minimum of 180 ºF working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1" w.g.	≤3 CFM/ft^2
Class I	4" w.g.	≤8 CFM/ft^2
Class I	8" w.g.	≤11 CFM/ft^2
Class I	12" w.g.	≤14 CFM/ft^2

G. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

H. Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40; other approved equal.

I. Aluminum frame and blade dampers: Nailor models 2010EAF & 202EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20; other approved equal.

J. Dampers used for directed mixing of airstreams, i.e. outside air and return air, to be parallel blade type and sized for an air velocity of 1800 to 2000 fpm with the damper blades shall be arranged so that the air streams are directed at one another to facilitate mixing. Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers may be parallel or opposed blade type.

K. Dampers used for isolation on the discharge of centrifugal fans shall have damper blades perpendicular to the fan shaft to minimize system effect. Dampers mounted with blades vertically shall be designed for vertical blade orientation.

L. Dampers for applications other than fume exhaust to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

M. Insulated low leak dampers shall have frames 8-1/8 inches X 1 inch X minimum 0.081 inch 6063-T-5 extruded aluminum hat-shaped channel, mounting flanges on both sides of frame and reinforced at the corners. Thermal gaskets break to prevent heat transmission through the frame. Minimum 2 insulated blade sets with a minimum of 4 inches of dead air space between sets. Dampers shall be Ruskin CD40X2 or equal.

N. Maximum damper width is 48 inches; where required width exceeds 48 inches, use multiple damper sections. Inside frame free area shall be a minimum of 90% of total inside duct area.

O. Multiple width damper sections shall utilize jack shaft linkages unless noted below. Sections over 144 inches wide shall be actuated from two locations on the jack shaft. Double width damper sections for two-position operation may be actuated without jack shafts if each damper section is actuated separately. Dampers that have multiple width and multiple vertical sections shall have a jackshaft for each vertically stacked set of dampers and be provided with crossover linkages between jack shafts to transfer uneven loading.

P. Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating actuators out of the air stream is impossible, obtain mounting location approval from the designer unless the contract documents indicate in air stream mounting is acceptable. In no cases shall damper actuators for fume exhaust systems be located in the air stream or require entering the air stream to service an actuator.

Q. Provide weatherproof stainless steel enclosures that have removable covers that do not require removing fasteners from the ductwork or NEMA 4 watertight actuators (Elodrive or equal) to prevent actuator failure or freeze-up when mounting in locations exposed to harsh environments or outdoor locations.

R. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered. For electric modulating actuation, use fully proportional actuators with 0-10VDC inputs and zero and span adjustments. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. Actuator stroke times shall match the requirements of the DDC controllers provided under section 23 09 23 and/or the specific system requirements for proper operation as specified in section 23 09 93. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Equip operators with spring return or stored energy fail-safe return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Provide damper end switches with form "C" contacts where control sequences require damper position indication. End switches shall not contain mercury.

S. All power required for electric actuation shall be provided by this Contractor if it is not able to be directly provided from the DDC controller.

T. Provide operators with linkages and brackets for mounting on device served.

2.3 SMOKE AND COMBINATION FIRE / SMOKE DAMPERS

A. Manufacturers:
1. Ruskin: www.ruskin.com.
2. Johnson Controls: www.johnsoncontrols.com.
3. Air Balance: www.airbalance.com.
4. Advanced Air: www.advancedair.net.
5. American Warming and Ventilating: www.awv.com.
6. Greenheck: www.greenheck.com.
7. Safe-Air: www.safe-air-corp.com.
8. Phillips-Aire: www.drillspot.com.
9. Prefco: www.www.prefco-hvac.com.
10. Pottorff: www.pottorff.com.
11. United Enertech: www.unitedenertech.com.
12. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Smoke damper assemblies to be UL 555S (4th edition) listed and labeled, and leakage rated at no higher than Class II under UL 555S (4th edition). Unless ratings are indicated elsewhere, dampers should be rated for minimum 2,000 fpm air velocity and 4" static pressure.

C. Combination fire/smoke damper assemblies to be UL 555(6th edition) and UL 555S(4th edition) listed and labeled, and have a fire rating compatible with the rating of the building assembly in which the damper is used, and be leakage rated at no higher than Class II under UL 555S.

D. Provide factory installed electrically operated dampers with linkage arranged so that the damper is closed on loss of power. For electric actuation, provide electric operated dampers with linkage and UL listed operators arranged so that the damper is closed on a loss of power. Where electric actuation is controlled by the DDC system use 0-10 VDC inputs, with stall protection, and with and zero and span adjustments for modulating or 24 VAC for two-position control. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Locate all operators out of the air stream unless large damper size will not allow. Provide form "C" end switches to indicate damper position.

E. Use airfoil shaped damper blades equal to Ruskin FSD60 when duct velocity will exceed 2,000 fpm.

2.4 DUCT SMOKE DETECTOR AND FIRE ALARM INTERFACE MODULES

A. Detectors with auxiliary contacts or fire alarm control modules will be provided by others. Provide wiring, conduit, and necessary interface with fire alarm system to perform specified sequence of operation.

2.5 CONTROL VALVES

A. Provide all control valves as shown on the plans/details and as required to perform functions specified.

B. Size operators to allow smooth and positive operation of devices served and to provide sufficient torque capacity for tight shutoff against system temperatures and pressure encountered. For electric modulating actuation, use fully proportional actuators with 0-10VDC inputs and zero and span adjustments unless specified otherwise in the chart below. If Floating with feedback is specified, valve position shall be fed back to the controller and controller shall position valve based on this feedback. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. Electric actuators, for applications other than terminal units, shall be provided with a manual override capability. All electric actuators shall be provided with a visible position indicator.

C. All power required for electric actuation shall be provided by this Contractor if it is not able to be directly provided from the DDC controller.

D. Provide operators that are full proportioning or two-position, as required for specified sequence of operation. Provide spring-return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Valves shall move to their fail positions on loss of electrical power or air pressure to the actuator.

E. Two-position shut-off valves shall be sized for a maximum pressure drop of 2 PSI at design flow and shall be a minimum of line size.

F. Provide operators with linkages and brackets for mounting on device served.

G. All valves unless specifically noted on the plans or indicated below shall be globe style valves.

CONTROL VALVE APPLICATION	**TYPE** Globe Butterfly (BF) Ball Press Independent Ball (PI Ball)	**SIGNAL** 0-10 VDC 2-Position Elect	**SPRING RETURN** REQUIRED	**FAIL POSITION** Open (thru Coil) Closed (bypass Coil) In Place
VAV Reheat	Globe or Ball	0-10 VDC	No	In Place
Reheat Coils	Globe or Ball	0-10 VDC	No	In Place
Radiation with Reheat	Globe or Ball	0-10 VDC	No	In Place
Stand-alone Radiation	Globe or Ball	0-10 VDC	No	In Place
CUH and UH	Globe or Ball	2-Pos Elect	Yes	Open
AHU Heating Coil	Globe	0-10 VDC	Yes	Open
AHU Cooling Coil	Globe or BF[1]	0-10 VDC	Yes	Closed

See plan details, notes, and schedules for where two-way and three-way valves should be used.
Equivalent Cv butterfly valves may be used where 3 inch and larger globe valves would be required.

H. WATER SYSTEMS:
1. Use equal percentage valves for two-way control valves; size for a pressure drop not less than 4 psi or more than 6 psi.
2. Use three-way valves sized for a maximum pressure drop of 5 psi and that have linear characteristics so that the valve pressure drop remains constant regardless of the valve position.
3. Globe valves 2 inches and smaller: Cast bronze or forged brass body, brass plug and brass or stainless steel seat, stainless steel stem, screwed ends, suitable for use on water systems at 150 psig and 240 °F. Seat leakage with actuator supplied will meet ANSI class IV leakage (0.01%). Only the following globe valve body styles will be acceptable for terminal unit control: Siemens Powermite 599 VF Series (599 VE Series Zone Valves are not acceptable), Invensys VB7200 Series, Johnson Controls VG7000 Series, and Honeywell V5011/V5013 Series or approved equal. Minimum size for globe valves shall be 1.5 Cv.
4. Globe valves 2-1/2 inches and larger: Iron body, brass plug and seat, stainless steel stem, spring loaded Teflon, or EPDM packing, flanged ends, suitable for use on water systems at 150 psig and 240 °F.
5. Butterfly valves: Iron body, stainless steel shaft, bronze bearings, and resilient seat. Disc to be aluminum-bronze, nickel-plated ductile iron, cast iron with welded nickel edge, or stainless steel. Valve assembly to be bubble tight, suitable for use on water systems at 150 psig and 240 °F. For pneumatically actuated valves, provide pilot positioners on all operators for butterfly valves used in modulating applications. When butterfly valves are used in modulating applications, entering and leaving pipe sizes and required transition distances shall be detailed on the control valve submittals. The Control Contractor shall be responsible for coordinating the proper pipe sizes and transitions with the Mechanical Contractor to provide the correct Cv at 70° open position.
6. Characterized Ball Valves: The following manufacturers are acceptable: Honeywell, Belimo, Johnson Controls, KMC Controls, Yamatake. For use on terminal units only where specified above. Forged brass or bronze body, stainless steel shaft and ball, reinforced Teflon or PTFE ball seals, double O-ring stem seals, characterized disk, maximum of ANSI Class IV (0.01%) leakage, suitable for use on water systems at 150 psig and 212 °F. Minimum size for ball valves shall be 1.0 Cv.
7. Pressure Independent Characterized Ball Valves: The following manufacturers and models are acceptable: Belimo model PICCV and Griswold Controls PIC-V. For use on terminal units only where specified above. Forged brass or bronze body, reinforced Teflon or PTFE ball seals, double O-ring stem seals, characterized disk, maximum of ANSI Class IV (0.01%) leakage, suitable for use on water systems at 150 psig and 212 °F. Flow shall be varied by actuator position and at any given position flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. Valves shall be pressure independent between a system differential pressure of 8 and 50 PSID. Minimum size for ball valves shall be 1.0 Cv.

2.7 CONTROL SYSTEM INSTRUMENTATION

A. DUCT THERMOMETERS:
1. 3-1/2 inch dial type with swivel mount. Maximum scale graduations of 2 °F. Provide averaging type, liquid filled capillary sensing element.

B. PIPE THERMOMETERS:
1. 9 inch stem type with an adjustable swivel mount. Scale graduations of 2 °F and mid-range accuracy of ±1 °F. Install thermometers in separable brass wells filled with conductive fluid.

C. REMOTE BULB THERMOMETERS:
1. 3-1/2 inch dial type with recalibration screw on face. Accuracy within 1% of scale range. Thermometers with sensing elements in air ducts with an area of above 4 square feet to have averaging elements. Provide separable wells for all pipeline applications.

2.8 ELECTRIC/ELECTRONIC THERMOSTATS

A. ELECTRIC THERMOSTATS: (On/Off or two-position control)
1. For single setpoint applications 55 ˚F to 85 ˚F, provide line or low voltage electric type suitable for heating or heating and cooling as required. Provide the required number of heating and/or cooling stages required for the application. For line voltage ventilation applications utilizing fans and where otherwise specified in the sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating shall be equal to electrical load of device being controlled. Provide on UL listed devices rated for the application.

B. LOW VOLTAGE ELECTRONIC THERMOSTATS: (Stand-alone modulating control)
1. Manufacturers:
a. Honeywell: www.honeywell.com.
b. Johnson Controls: www.johnsoncontrols.com.
c. White Rogers: www.whiterogers.com.
d. Siemens: www.siemens.com.
e. Substitutions: Refer to Section 01 60 00 - Product Requirements.
2. Where unoccupied setpoints are specified, provide electronic programmable type with seven day setup/setback scheduling with a minimum of two occupied and unoccupied schedules per day through keypad entry on front of unit. For heating and cooling applications, provide automatic heating/cooling switchover. For applications that control fans, provide fan override switch. For ventilation or packaged economizer applications provide a dry contact for ventilation damper or economizer initiation. For thermostat control of economizer, provide a 0-10VDC modulated output for economizer damper control.
3. For applications that require integration to the building automation system, provide a BACnet communication interface.

C. AQUASTATS:
1. Line voltage type with single pole, double throw switch of adequate rating for the applied load.

D. REMOTE BULB THERMOSTATS:
1. Line voltage type with single pole, double throw switch of adequate rating for the applied load. Thermostat to have adjustable setpoint suitable for controlled load.

E. IMMERSION TYPE THERMOSTAT:
1. Rod and tube type with linear output. Provide separable wells with heat conductive fluid for installation in pipeline. Units shall be factory calibrated.

F. LOW LIMIT THERMOSTATS (freezestats):
1. Electric two-position type with temperature sensing element and manual reset. Unit to be capable of opening control circuit if any one-foot length of sensing element is subject to a temperature below the setpoint. Length of sensing element to be not less than one lineal foot per square foot of coil surface areas. Unless otherwise indicated, set low limit controls at 36 °F.

2.9 TEMPERATURE CONTROL PANELS

A. Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide as-built wiring/piping diagram within enclosure. Provide raceways for wiring and poly within panel for neat appearance and to separate high and low voltage wiring. Provide termination blocks and resettable circuit breaker for 120VAC power wiring. Label panel with panel number corresponding to as-built control drawings and building system(s) served.

2.10 AIR FLOW STATIONS

A. Provide duct mounted airflow station type based on the following minimum design velocities. Pitot or thermal dispersion flow stations can be used for fan inlet flow stations. Outside air flow stations shall be thermal dispersion type only. Turndown of variable volume fan systems must be considered. Provide an airflow station schedule detailing the airflow range to be measured, corresponding velocity pressure, differential pressure transducer range, and the airflow station size.

Air Velocity	Duct Mounted Air Flow Station Type
0-700 FPM	Thermal Dispersion
>700 FPM	Thermal Dispersion or Multi-probe velocity pressure pitot style

B. Duct mounted Multi-probe velocity pressure pitot air flow stations:
   1. Multi-probe duct velocity pressure sensing station constructed of minimum 16 gauge galvanized steel casing, and multiple metallic velocity pressure sensors with automatic averaging manifold. For duct installations, provide an aluminum honeycomb cell air straightener with maximum openings of 1/2 inch and minimum of 3 inch depth. Each airflow measuring element shall contain multiple Total and Static pressure sensors, placed at equal distances (for rectangular Ducts) and at concentric area centers (for circular ducts) along the element length. The number of sensors on each element and the quantity of elements utilized at each installation shall comply with the ASHRAE standards for duct traversing. The airflow measuring elements shall be capable of producing steady, non-pulsating Total and Static pressure signals, with accuracy within ±2% of actual flow. Airflow resistance to be less than or equal to 0.23 inches of water at 4000 feet per minute air velocity.

C. Fan inlet probe air flow stations:
   1. For fan inlet probes provide two probes for each fan inlet (for DWDI fans provide four probes). Pressure drop caused by the airflow elements shall not exceed 0.03” w.c. at 2000 FPM. Airflow elements shall be provided with all necessary pivot mounting hardware and signal connection fittings for connection to tubing provided by the installing Contractor. For pitot type air flow stations, the static and total pressure manifold piping by the installing Contractor shall be piped symmetrically so take-off will be located where line lengths between all probes are equal in length.

D. For duct mounted and fan inlet pitot flow stations, air velocity transducers range shall be sized less than two times the design velocity pressure at maximum flow and will meet the requirements under the PRESSURE TRANSDUCERS (AIR) specification later in this specification section unless noted below.

E. Thermal dispersion air flow stations:
   1. Manufacturers:
      a. Ebtron, Air Monitor, Kurz Instruments.
      b. Probe Sensor Density:

Area (sq. ft.)	Sensors
<= 1.5	2
>1.5 to <4	4

4 to <8	6
8 to <12	8
12 to <16	12
>=16	15

c. Airflow Sensor Accuracy: ±2% of reading.
d. Calibrated Range: 0-5000 FPM.
e. Temperature Sensor Accuracy: ±0.15°F.
f. Temperature: -20°F to +140°F.
g. Relative Humidity: 0 to 95% (non-condensing).

F. Provide transmitter that will average up to sixteen sensors and provide two field selectable linear analog output signals (4-20mA and 0-10 VDC) proportional to airflow and temperature. Sensor electronic circuitry other than the temperature sensors shall not be exposed to the air stream and shall be protected from moisture to prevent failure.

G. Local display of flow rate to be provided in a steel NEMA 4 wall mounted enclosure with internal terminal strip connections and shall be powered by 24 VAC or VDC and provide necessary power to flow meter. Display shall read in cubic feet per minute.

2.11 WATER FLOW MEASUREMENT

A. Manufacturers:
1. Onicon Inc.: www.onicon.com.
2. Flow Technology, Inc.: www.flowtechnology.com.
3. Hoffer Flow Controls, Inc.: www.hofferflowcontrols.com.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Provide an Insertion Turbine Flow Sensor complete with all installation hardware necessary to enable insertion and removal of the flow sensor under pressure without system shutdown. Turbine rotors shall be of the axial design – tangential paddle type rotors will not be acceptable. When dictated by short available pipe runs, the flow measurement station shall provide compensation for rotational distortion in the velocity flow profile caused by upstream conditions.

C. The manufacturer shall provide a certificate of NIST traceable wet-calibration for each sensor. Accuracy shall be as follows:
1. +/-0.5% of actual reading at the calibrated typical velocity.
2. +/- 1% of reading over a 10:1 turndown (from 3 to 30 ft/s).
3. +/- 2% of reading over a 50:1 turndown (from 0.4 to 20 ft/s).
4. Overall range ability shall be from 0.17 ft/s to 30 ft/s (175:1 turndown ratio).

D. The sensor shall have a maximum operating pressure of 400 PSI, maximum operating temperature of 200 °F (optional 300 °F peak) and a pressure drop of less than 1 PSI at 17 feet per second flow velocity.

E. The sensor shall have a minimum of one analog output, 0-10 VDC or 4-20 mA for connection to the DDC control system for liquid flow rate unless the sensor is connected to a BTU measurement system that will provide this output or be directly integrated to the DDC control system. The sensor shall also include integral frequency output for diagnostic purposes and for connection to local display. All outputs shall be linear with flow rate.

F. Local display of flow rate to be provided in a steel NEMA 4 wall mounted enclosure with internal terminal strip connections and shall be powered by 24 VAC or VDC and provide necessary power to flow meter. Display shall read in gallons per minute.

2.12 TEMPERATURE SENSORS

A. Use thermistor or RTD type temperature sensing elements constructed so accuracy and life expectancy is not affected by moisture, physical vibration, or other conditions that exist in each application.

B. RTD's shall be of nickel or platinum construction and have a base resistance of 1000Ω at 70 °F and 77 °F respectively. 100Ω platinum RTD's are acceptable if used with temperature transmitters.

C. The temperature sensing device used must be compatible with the DDC controllers used on the project.

D. RTD:

1.	Accuracy (Room Sensor Only)	minimum ± 1.0°F.
2.	Accuracy (Averaging)	minimum ± 1.2°F.
3.	Accuracy (Other than Room Sensor or Averaging)	minimum ± 0.65°F.
4.	Range	minimum -40 - 220°F.

E. Temperature Transmitter:

Accuracy	minimum ± 0.1°F or ±0.2% of span.
Output	4-20 mA.

F. Provide limited range or extended range sensors if required to sense the range expected for a respective point. Use RTD type sensors for extended ranges beyond -30 to 230 °F. If RTD's are incompatible with DDC controller direct temperature input use temperature transmitters in conjunction with RTD's.

G. Use wire size appropriate to limit temperature offset due to wire resistance to 1.0 °F. If offset is greater than 1.0 °F due to wire resistance, use temperature transmitter. If feature is available in DDC controller, compensate for wire resistance in software input definition.

H. Provide sensors in occupied spaces with brushed aluminum or brushed nickel covers unless otherwise noted or features specified will not allow for this. Terminal unit sensors with setpoint adjustments and digital displays may use plastic covers. Provide information to the Engineer on sensor colors offered by the manufacturer and obtain approval on what color should be provided on the project.

I. Terminal unit sensors shall be provided with digital displays that indicate room temperature and setpoint and have a manual occupancy override and indication of occupancy status. Provide setpoint adjustment as specified in the Input / Output Summary and sequence of operation.

J. Use averaging elements on duct sensors when the ductwork is ten square feet or larger. All mixed air and heating coil discharge sensors shall have averaging elements regardless of duct size.

K. In piping systems use temperature sensors with separable wells designed to be used with temperature element.

2.13 HUMIDITY SENSORS

A. Use capacitive thin-film polymer sensor types with a range of 0-100% RH. Accuracy to be no less than +/-2% in the range of 20% RH to 80% RH with a response time of 120 seconds or less. Provide covers for room humidity sensors as specified for temperature sensors.

B. For outside air applications, use sensor designed for outside air use along with weather enclosure. Provide sensor equal to Vaisala Model HMD60UO with DTR503B enclosure and weather resistant mounting hardware.

2.14 AIR PRESSURE TRANSDUCERS

A. Provide pressure transducers specified below for the following applications:
   1. Duct static pressure applications where setpoints are specified to control at greater than 0.1" w.c.
   2. Pitot type fan inlet air flow stations.
   3. Terminal unit air flow measurement regardless of the minimum velocity pressure unless otherwise noted in the contract documents.

B. Manufacturers:
   1. Mamac Systems: www.mamacsys.com.
   2. Setra: www.serta.com.
   3. Veris Industries: www.veris.com.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

C. Provide a transmitter that operates on the capacitance principle and is capable of sensing low positive, negative or differential pressures. Transmitter shall have a minimum of three pressure ranges adjustable by an onboard switch or jumper. Size the transmitter where the middle or high range is suitable for the application. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions. Transmitter shall be provided with an integral four-digit display of the pressure sensed.

1.	Accuracy (including non-linearity and hysteresis)	± 1% FS.
2.	Compensated Temperature Range	32°-140 °F.
3.	Temperature Effect	0-1"wc Range .09% FS/°F; >1"wc Range .02% FS/°F.
4.	Output	4-20 MA.
5.	Load Impedance (smallest maximum acceptable)	800 Ω max.
6.	Operating Temperature	32°-140 °F.

D. Pressure transducers used for supply VAV box flow applications do not need to have adjustable pressure ranges or integral display.

E. Provide pressure transducers specified below for the following applications:
   1. Duct static pressure applications where setpoints are specified to control at 0.1" w.c. or lower.
   2. All duct mounted pitot type air flow stations.
   3. Space/building static control or monitoring.

F. Manufacturers:
   1. Paragon Controls; MicroTrans: www.paragoncontrols.com.
   2. Air Monitor; Veltron DPT2500 Plus: www.airmontor.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

G. The airflow transducer shall provide noise filtration and automatic auto-zeroing. The automatic zeroing circuit shall be capable of maintaining the transducer output to within +/- 0.25% of operating span. The transducer output shall be locked and maintained at the last given output value during the automatic zeroing period so as not to interrupt the automatic control process. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions. Transmitter shall be provided with an integral four-digit display of the pressure sensed.
   1. Transducer Span: <2 times the design velocity pressure at maximum flow, single range.
   2. Accuracy: ±0.25% of full scale, including non-linearity, hysteresis, deadband, and non-repeatability.
   3. Temperature Effect: ±0.15% of full scale/°F.
   4. Response: 0.5 sec. for 98% of full span change.
   5. Overpressure: 5 PSIG Proof.
   6. Power: 24VAC/VDC.
   7. Analog Output: 0-5VDC, 0-10VDC, or 4-20mA field adjustable.
   8. Auto Zero Frequency: Every 1 to 24 hours on 1 hour intervals.

2.15 LIQUID PRESSURE TRANSDUCERS

A. Provide a transmitter that utilizes capacitive or thin film strain gauge sensing. Provide for an analog gauge piped in parallel with the transducer. Gauge shall meet specifications. Coordinate with Mechanical Contractor to provide and install this gauge. For differential pressure applications provide with bypass valve manifold assembly with valved venting capability.

1.	Accuracy (including non-linearity and hysteresis)	± 0.5% FS.
2.	Compensated Temperature Range	32°-150 °F.
3.	Temperature Effect (over compensated range)	0.03%/°F;
	Output	4-20 MA.
4.	Load Impedance (smallest maximum acceptable)	600 Ω Minimum.
5.	Operating Temperature	0°-175 °F.
6.	Hysteresis	0.75% of span.

2.16 AIR DIFFERENTIAL PRESSURE SWITCHES

A. Differential pressure switches shall sense both inlet and outlet of fans. Device shall be rated for 150% of maximum system pressures that may be encountered. Provide with pressure differential that will be required to meet specified operation and/or to prevent nuisance lockouts of the device in the system served.

B. Differential pressure switches shall be diaphragm type, with die-cast aluminum housing and adjustable set point. Switch rating shall be a minimum 5 amps at 120 VAC. Switches shall be SPDT and be used for fan status as specified in the Input / Output Summary. Switch pressure range shall be suited for application. (e.g. filter 0-2.0", fan status 0-5.0", fan static safety 0-5.0”). For fan static limit applications provide the device with manual reset.

2.17 LIQUID DIFFERENTIAL PRESSURE SWITCHES

A. Differential pressure type switches shall be UL listed, SPDT snap-acting, pilot duty rated for 125 VA minimum, NEMA 1 enclosure, with scale range and differential suitable for the intended application or as shown in the Input / Output Summary.

2.18 FLOW SWITCHES

A. Stainless steel paddle type flow switches shall be UL listed, SPDT snap-acting, pilot duty rated for 125 VA minimum, NEMA 1 enclosure suitable for intended application or as shown in the Input / Output Summary. Provide a device equal to McDonnell & Miller FS4.

B. For critical applications use a thermal dispersion type flow sensor equal to a Magnetrol TA-2.

2.19 CURRENT STATUS SWITCHES

A. Provide a current sensor with adjustable threshold and digital output with LED display, equal to a Veris model H-708/H-904. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor that will automatically compensate for frequency and amperage changes associated with variable frequency drives. When used on variable speed motor applications, use a current sensor that will not change state due to varying speeds.

2.20 CURRENT TRANSDUCER (THESE DEVICES ARE USED WITH DDC SYSTEMS TO MONITOR / TREND ACTUAL MOTOR CURRENT)

A. The current transducer shall be self powered (2 wire) induced from the monitored conductor. The current transducer shall have a slide switch for amperage range selection with ranges of 0-20, 0-100, 0-150 Amps, shall be isolated to 600 VAC, output shall be 0-10 VDC, shall be split core with self gripping iris, and optional drill mount bracket. Provide a device equal to Veris Industries Hawkeye H-923.

2.21 CARBON DIOXIDE (CO2) SENSOR (THESE DEVICES ARE USED WITH DDC SYSTEMS TO MONITOR / TREND CO2 LEVELS AND CAN BE USED TO ADJUST VENTILATION / AIRFLOW RATES)

A. Provide a Carbon Dioxide (CO_2) sensor that shall utilize non-dispersive infrared (NDIR) technology. The sensor shall have a linear analog output over a range of 0-2000 ppm and have built in display of CO_2 level. The sensor shall have an automatic calibration algorithm that will compensate for sensor drift over time due to sensor element degradation. Unit shall be provided with a 0-10VDC or 4-20mA analog output that is selectable and a field adjustable relay alarm output. Accuracy shall be better than ±5% of reading or ±50ppm whichever is higher. The sensor shall be user calibratable with a minimum calibration interval of five years.

2.22 POWER SUPPLIES

A. Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system with trained mechanics and electricians employed by the control equipment manufacturer or an authorized representative of the manufacturer. Where Installing Contractor is an authorized representative of the control manufacturer, such authorization shall have been in effect for a period of no less than three years.

B. Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control devices must be installed in accessible locations. This Contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified in Section 23 09 93.

C. All cables to the electronic input/output devices, sensors, relays and interlocking wiring (all of which shall be supplied and installed under this section of specification) interfaced with the Direct Digital Control System shall be extended into the 23 09 23 DDC panel with a minimum of 5 ft. of cable to allow for termination by the DDC System Contractor. This Contractor shall provide a technician to inspect and validate all tubing, wiring, and field devices associated with the DDC interface in coordination with and under direction of the 23 09 23 DDC Contractor to ensure that each device is operating per the control sequences as specified in Section 23 09 93.

D. Label all control devices with the exception of dampers, valves, and terminal unit devices with permanent printed labels that correspond to control drawings. Temperature control junction and pullboxes shall be identified utilizing spray painted green covers. Other electrical system identification shall follow the 26 05 53 specification.

E. All control devices and electrical boxes mounted on insulated ductwork shall be mounted over the insulation. Provide mounting stand-offs where necessary for adequate support. Cutting and removal of insulation to mount devices directly on ductwork is not acceptable. This Contractor shall coordinate with the insulation Contractor to provide for continuous insulation of ductwork.

F. Mounting of electrical or electronic devices shall be protected from weather if the building is not completely enclosed. This Contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates the building if equipment is installed prior to the building being enclosed.

G. Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All conduit must be installed in accordance with electrical sections (Division 26) of this specification and the National Electrical code.

H. Conduit shall be a minimum of 1/2 inch for low voltage control provided the pipe fill does not exceed 40%.

I. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

J. Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations should be in conduit.

K. Wire for wall sensors must be run in conduit. Wiring for radiation valves shall be run in conduit where routed through walls.

L. Where wiring is installed free-air, installation shall consider the following:
   1. Wiring shall utilize the cable tray wherever possible.
   2. Wiring shall run at right angles and be kept clear of other trades work.
   3. Wiring shall be supported utilizing “J” or “Bridal-type” steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through the ring. For mounting rings that do not completely surround the wire, attach the wire to the mounting ring with a strap.
   4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If wiring “sag” at mid-span exceeds 6-inches; another support shall be used.
   5. Wiring shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.
   6. Wall penetrations shall be sleeved.

M. Wiring shall not be attached to ductwork, ceiling supports or electrical or communications conduit.

N. Control panels serving equipment fed by emergency power shall also be served by emergency power. This Contractor shall be responsible for all 120VAC power, not provided in the Division 26 specifications, required for equipment provided under this section. Power shown for temperature control panels on plans may be utilized by the 23 09 23 and 23 09 13 Contractors.

O. Provide communication trunk wiring to integrated devices (i.e. VFD’s, Flow Meters, Chillers, Lighting Panels, Electrical Meters, etc.) that are specified to be connected to the building automation system. Communication trunk wiring shall be as required by the equipment specified under the 23 09 23 sections and shall be routed to the DDC panel designated for that equipment as shown on the plans or the closest DDC panel if not designated. If communication trunks required daisy chained style wiring, provide two communication cables.

P. Install "hand/off/auto" selector switches on systems where automatic interlock controls are specified and "hand/off/auto" selector switches are not supplied with the equipment controlled. Control panel power will not be required for “hand” switch to operate. When switch is in "hand" position, allow manual operation of the selected device without operating the interlocked motors but allowing all unit safety devices to stay in the circuit.

Q. All electrical wiring are to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with the "Record Drawings".

R. Label all control components (valves, damper actuators, sensors…etc.) to match the 23 09 23 control submittals.

S. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.2 CONTROL, COMBINATION FIRE / SMOKE, AND SMOKE DAMPERS

A. All dampers furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Control Contractor in locations shown on plans or where required to provide specified sequence of control.

B. Coordinate installation with the sheetmetal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted.

C. For control dampers, each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.

3.3 CONTROL VALVES

A. All temperature control valves furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Control Contractor in locations shown on plans or where required to provide specified sequence of control.

3.4 CONTROL SYSTEM INSTRUMENTATION

A. Install thermometers at each point of temperature transmission (sensors) and control, except reheat coils, unless the drawings indicate a thermometer is to be installed by the piping or sheetmetal installer. Install thermometers to permit easy reading from the floor or operating platform. Provide remote mounting or swiveled mounting as required for easy reading. Flush mounting where not easily read is not acceptable.

3.5 ELECTRIC / ELECTRONIC ROOM THERMOSTATS

A. Check and verify location of thermostats and humidistats with plans and room details before installation. Locate room thermostats 60 inches above floor for non-adjustable, 70 inches above floor where furniture is located, 48 inches above floor for all adjustable devices. Align with light switches and humidistats. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

B. Any room thermostats mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

C. Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will affect the measurement.

D. Provide guards on thermostats in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

3.6 TEMPERATURE CONTROL PANELS

A. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide permanent printed labeling for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

B. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

3.7 LOW LIMIT THERMOSTATS (Freezestats)

A. Install low limit controls where indicated on the drawings or as specified. Unless otherwise indicated, install sensing element on the downstream side of heating coils.

B. Mount units using flanges and element holders. Provide duct collars or bushings where sensing capillary passes through sheet metal housings or ductwork; seal this penetration to eliminate air leakage. Mount the units in an accessible location as to allow for resetting after low limit trips while still meeting manufacturer's installation requirements for proper function.

C. Distribute (serpentine) sensing element horizontally across the coil to cover every square foot of coil; on larger coils this may require more than one instrument. Install controls at accessible location with mounting brackets and element duct collars where required.

3.8 AIR FLOW STATIONS

A. Install airflow stations in accordance with manufacturer's recommendations. Install straightening vanes upstream of unit where required per manufacturers recommendations. Program local displays to read in cubic feet per minute. Coordinate calibration with the test and balance Contractor.

3.9 LIQUID FLOW SENSORS

A. Install where indicated on the drawings and details for flow sensing in hydronic piping systems. Do not install close to elbows, valves, or other piping specialties, which might affect the reading of the sensor; follow manufacturer's installation instructions. Where flow meters are located more than five feet above the floor or where they cannot be read due to equipment location, provide remote mounting of the flow meter display and programming controls. Location of remote mounted display shall be so that the flow measurement display shall be mounted four to five feet above finished floor. BTU Measurement System displays shall be located so that the display and programming controls are four to five feet above finished floor. Coordinate calibration with the test and balance Contractor.

3.10 ROOM SENSORS

A. Check and verify location of sensors and humidity sensors with plans and room details before installation. Locate room sensors 60 inches above floor for non-adjustable, 70 inches above floor where furniture is located, 48 inches above floor for all adjustable devices. Align with light switches and humidity sensors. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

B. Any room sensors mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

C. Where sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will affect the measurement.

D. Provide guards on sensors in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

3.11 AIR AND WATER PRESSURE TRANSDUCERS

A. Install capped tees in air piping at air pressure transducers for connection of calibration equipment. Capped tee shall consist of two inch poly tubing capped with a brass plug. Rubber caps are not acceptable.

B. Install Pete's Plugs or acceptable fittings at each take-off from main piping for liquid pressure transducers for connection of calibration equipment for the purpose of device validation.

C. Install differential pressure transducers for filter monitoring at the filter section of the air handling unless otherwise specified. All other differential or static pressure transducers for air applications should be mounted in the temperature control panel serving the equipment being monitored. Duct static pressure transmitters can be remotely mounted if there location is noted on the record drawings. In addition, the device must be installed in an accessible location.

D. For liquid applications, provide shutoff valves at piping takeoff points with test port for device testing.

3.12 AIR AND LIQUID DIFFERENTIAL PRESSURE SWITCHES

A. Provide for each fan or pump specified, or shown on point list. Provide shutoff valves at piping takeoff points. Readjust pressure and/or differential setpoints for proper operation after final balancing is completed.

B. Differential or static pressure high limit switches can be mounted on the equipment served. All devices mounted on equipment shall be mounted in a location that is at a maximum of five feet above the floor.

3.13 WATER FLOW SWITCHES

A. Shall be installed by the Mechanical Contractor. It is the responsibility of this Contractor to ensure these devices are installed in accordance with the manufacturer's recommendations.

3.14 CURRENT STATUS SWITCHES

A. Provide for each fan or pump specified, or shown on the Input / Output summary. Set threshold adjustment to indicate belt or coupling loss. Readjust threshold for proper operation after final balancing is completed. Use the variable frequency drive (VFD) integrated relay output for motor status, if provided on the VFD, in lieu of a discrete current switch. A separate current switch provided under this section shall be wired in parallel with the VFD motor status relay when a bypass starter is provided on the VFD to prove motor status in the bypass mode.

3.15 CARBON DIOXIDE SENSORS

A. Install in accordance with manufacturer's recommendations.

3.16 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.

END OF SECTION

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SECTION 23 09 23 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a complete Direct Digital Control (DDC) system. This system interfaced with electric controls (Section 23 09 13) utilizing Direct Digital Control signals to operate actuated control devices will meet, in every respect, all operational and quality standards specified herein.

1. PART 1 - GENERAL
    a. Scope.
    b. Related Work.
    c. Reference.
    d. Reference Standards.
    e. Work Not Included.
    f. Quality Assurance.
    g. Submittals.
    h. Operation and Maintenance Data.
    i. Material Delivery and Storage.
    j. Warranty.
2. PART 2 - PRODUCTS
    a. General.
    b. Manufacturers.
    c. Local Control Panels.
    d. Direct Digital Controls (DDC).
    e. Networking/Communications.
    f. Integrated Communications to Third Party Equipment.
    g. Supervisory Controllers.
    h. System Software Features.
    i. Programmable Controllers.
    j. Application Specific Controllers – HVAC Applications.
    k. Operator Interface Requirements.
    l. Operator Work Station & DDC Server.
3. PART 3 - EXECUTION
    a. General.
    b. Installation.
    c. Owner Training.
    d. Demonstration Testing.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

D. Section 23 09 93 - Sequence of Operation for HVAC Controls.

E. Input / Output Summary – See project drawings.

F. Division 23 - HVAC - Equipment provided to be controlled or monitored.

G. Division 26 - Electrical - Equipment provided to be controlled or monitored.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference.

1.5 WORK NOT INCLUDED

A. Section 23 09 13 work includes furnishing and installing all field devices, including electronic sensors for the DDC of this section, equipment, and all related field wiring, interlocking control wiring between equipment, sensor mounting, etc., that is covered in that section.

B. Motorized control dampers and actuators, temperature sensing wells, automatic control valves and their actuators are also covered in Section 23 09 13.

1.6 QUALITY ASSURANCE

A. MANUFACTURER:
   1. A firm regularly engaged in manufacture of DDC control equipment similar to the specified equipment and has been in satisfactory similar service for not less than 5 years.

B. INSTALLER:
   1. A firm specializing and experienced in DDC control system installation for no less than 3 years. All work shall be done by qualified mechanics in the direct employ of this manufacturer, or of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturers control equipment. Where installing Contractor is an authorized representative of the control equipment manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing Contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of equipment and systems to be provided for the project, and that such authorization has been in effect for a period of not less than three years.

C. RESPONSE TIME:
   1. During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.

D. ELECTRICAL STANDARDS:
   1. Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

E. DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with F.C.C. rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (Part 15, Subpart J, Class A).

1.7 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. PRODUCT DATA:
   1. Submit manufacturer's specifications for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked. Annotated software program documentation shall be submitted for system sequences, along with descriptive narratives of the sequence of operation of the entire system involved. Submit wiring diagram for each electrical control device along with other details

required to demonstrate that the system has been coordinated and will function as a system.

C. MAINTENANCE DATA:
   1. Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.

D. RECORD DRAWINGS:
   1. Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Electric fieldwork. Accurate Section 23 09 13 record drawings to be supplied by the Section 23 09 13 Contractor with the accuracy of these drawings being the responsibility of the 23 09 13 Contractor. In the event that changes are required to the 23 09 13 supplied record drawings after they have been compiled by the 23 09 23 Contractor, it shall be the 23 09 13 Contractors responsibility to provide updated composite record drawings incorporating the 23 09 23 record drawings.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.9 MATERIAL DELIVERY AND STORAGE

A. Provide factory shipping cartons for each piece of equipment and control device. This Contractor is responsible for storage of equipment and materials inside and protected from the weather.

1.10 WARRANTY

A. Provide a 1 year warranty on all materials and workmanship.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide DDC control products in sizes and of capacities as required, conforming to manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by the manufacturer and as required for application indicate.

B. System shall be capable of operating with 120 VAC power supply, fully protected with a shutdown-restart circuit, and associated hardware and software.

2.2 MANUFACTURERS

A. Trane: www.trane.com.

B. Johnson Controls: www.johnsoncontrols.com.

C. Honeywell: www.honeywell.com.

D. EcoStruxure Building Operation (EBO) – Schneider Electric.

E. Siemens: www.siemens.com.

F. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.3 ARCHITECTURE/COMMUNICATION

A. This project shall be comprised of a high speed Ethernet network utilizing BACnet/IP communications between System Controllers and Workstations. Communications between System Controllers and sub-networks of Custom Application Controllers and/or Application Specific Controllers shall utilize BACnet/Zigbee wireless communications. **Wired control systems may be bid as an alternate, but low voltage wiring shall be installed in electrical metallic tubing (EMT) conduit.**

1. Each System Controller shall perform communications to a network of Custom Application and Application Specific Controllers using BACnet/Zigbee (802.15.4) as defined by the Zigbee Standard.
   a. Each communication interface shall be Zigbee Building Automation Certified product as defined by the BACnet Standard and the Zigbee Alliance.
   b. Each System Controller shall function as a BACnet Router to each unit controller providing a unique BACnet Device ID for all controllers within the system.
   c. The Controls Contractor shall provide all communication media, connectors, repeaters and network switches routers necessary for the high speed Ethernet communications network.
2. All values within the system – contained in both the system and unit controllers - (i.e. Schedules, Data Logs, Points, Application Variables, Custom Program Variables) shall be readable and controllable (where appropriate) by any System Controller or BACnet Workstation on the communications network via BACnet.

2.4 OPERATOR INTERFACE

A. Furnish PC based operator interface as shown on the system drawings. Each operator interface shall be able to access all information in the system. Operator interfaces shall reside on the same high-speed network as the System Controller(s).

1. Each operator interface PC shall include the following:
   a. Hardware type.
   b. Laptop.
2. Operating Systems
   a. Windows 7/8/10.
3. Minimum Hardware
   a. Intel i5 or better.
   b. 8 GB RAM.
   c. 500 GB hard drive space.
   d. Internet Browser compatible with operator interface requirements outlined in the operator interface section.
4. Operator Interface
   a. The operator interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
   b. The operator interface shall support the following Internet web browsers:
      1) Internet Explorer 10.0+
      2) Firefox 29.0+
      3) Chrome 35.0+
   c. The operator interface shall support the following mobile web browsers:
      1) iOS (iPad/iPhone) V7.0+
5. System Security
   a. Each operator shall be required to login to the system with a user name and password in order to view, edit, add, or delete data.
   b. User Profiles shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator.
   c. Each operator shall be allowed to change their user password

d. The System Administrator shall be able to manage the security for all other users
e. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
f. User logon/logoff attempts shall be recorded.
g. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
h. All system security data shall be stored in an encrypted format.

6. Database
   a. Database Save. A system operator with the proper password clearance shall be able to archive the database on the designated operator interface PC.
   b. Database Restore. The system operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
7. On-Line Help and Training
   a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
   b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.
8. System Diagnostics
   a. The system shall automatically monitor the operation of all network connections, building management panels, and controllers.
   b. The failure of any device shall be annunciated to the operators.
9. Equipment & Application Pages
   a. The operator interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application.
10. Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
    a. Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.
       1) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
       2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
       3) Historical Data (As defined in Data Log section below) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
    b. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.
    c. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point and-click navigation between zones or equipment, and to edit set points and other specified parameters.
    d. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
    e. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
    f. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

g. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

11. Custom Graphics
    a. The operator interface shall be capable of displaying custom graphics in order to convey the status of the facility to its operators.
    b. Graphical Navigation. The operator interface shall provide dynamic color graphics of building areas, systems and equipment.
    c. Graphical Data Visualization. The operator interface shall support dynamic points including analog and binary values, dynamic text, static text, and animation files.
    d. Custom background images. Custom background images shall be created with the use of commonly available graphics packages such as Adobe Photoshop. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as GIF and JPEG.
12. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
13. Manual Control and Override.
    a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
    b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
    c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
    d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
14. Engineering Units
    a. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system.
    b. Unit selection shall be able to be customized by locality to select the desired units for each measurement.
    c. Engineering units on this project shall be SI.
15. Scheduling. A user shall be able to perform the following tasks utilizing the operator interface:
    a. Create a new schedule, defining the default values, events and membership.
    b. Create exceptions to a schedule for any given day.
    c. Apply an exception that spans a single day or multiple days.
    d. View a schedule by day, week and month.
    e. Exception schedules and holidays shall be shown clearly on the calendar.
    f. Modify the schedule events, members and exceptions.
16. Data Logs
    a. Data Logs Definition.
        1) The operator interface shall allow a user with the appropriate security permissions to define a Data Log for any data in the system.
        2) The operator interface shall allow a user to define any Data Log options as described in the Application and Control Software section.
    b. Data Log Viewer.
        1) The operator interface shall allow Data Log data to be viewed and printed.
        2) The operator interface shall allow a user to view Data Log data in a text-based format (time –stamp/value).

3) The operator shall be able to view the data collected by a Data Log in a graphical chart in the operator interface.
4) Data Log viewing capabilities shall include the ability to show a minimum of 5 points on a chart.
5) Each data point data line shall be displayed as a unique color.
6) The operator shall be able to specify the duration of historical data to view by scrolling and zooming.
7) The system shall provide a graphical trace display of the associated time stamp and value for any selected point along the x-axis.

c. Export Data Logs.
1) The operator interface shall allow a user to export Data Log data in CSV or PDF format for use by other industry standard word processing and spreadsheet packages.

d. Alarm/Event Notification
1) An operator shall be notified of new alarms/events as they occur while navigating through any part of the system via an alarm icon.
2) Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any operator interface.
3) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
4) Alarm/event messages shall use full language, easily recognized descriptors.
5) An operator with the proper security level may acknowledge and clear alarms/events.
6) All alarms/events that have not been cleared by the operator shall be stored by the building controller.
7) The alarm/event log shall include a comment field for each alarm/event that allows a user to add specific comments associated with any alarm.

e. Alarm Processing.
1) The operator shall be able to configure any object in the system to generate an alarm when transitioning in and out of a normal state.
2) The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.

17. Reports and Logs.
a. The operator interface shall provide a reporting package that allows the operator to select reports.
b. The operator interface shall provide the ability to schedule reports to run at specified intervals of time.
c. The operator interface shall allow a user to export reports and logs from the building controller in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Acceptable formats include:
1) CSV, HTML, XML, PDF.
d. Reports and logs shall be readily printed to the system printer.
e. Provide a means to list and access the last 10 reports viewed by the user.
f. The following standard reports shall be available without requiring a user to manually configure the report:
1) All Points in Alarm Report: Provide an on demand report showing all current alarms.
2) All Points in Override Report: Provide an on demand report showing all overrides in effect.
3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
4) Points report: Provide a report that lists the current value of all points

18. VAV Air System. An operator shall be able to view and control (where applicable) the following parameters via the operator interface:
    a. System Mode.
    b. System Occupancy.
    c. Ventilation (Outdoor air flow) setpoint.
    d. Ventilation (Outdoor air flow) status.
    e. Air Handler Static pressure setpoint.
    f. Air Handler Static pressure status.
    g. Air Handler occupancy status.
    h. Air Handler Supply air cooling and heating set points.
    i. Air Handler minimum, maximum and nominal static pressure setpoints.
    j. VAV box minimum and maximum flow.
    k. VAV box drive open and close overrides.
    l. VAV box occupancy status.
    m. VAV box Airflow to space.
    n. Average space temperature.
    o. Minimum space temperature.
    p. Maximum space temperature.

2.5 APPLICATION AND CONTROL SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator interface.
    1. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:
        a. Weekly Schedule. Provide separate schedules for each day of the week.
        b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
        c. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
        d. Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
    2. Data Log Application.
        a. Data Log data shall be sampled and stored on the System Controller panel and shall be capable of being archived to a BACnet Workstation for longer term storage.
            1) Data Log sample types shall include interval, start-time, and stop-time.
            2) Data Log intervals shall be configurable as frequently as 1 minute and as infrequently as 1 year.

b. Data Logs.
1) The system controller shall contain Data Log information for defined key measurements for each controlled HVAC device and HVAC application.
2) The Data Logs shall monitor these parameters for a minimum of 7 days at 15 minute intervals. The Data Logs intervals shall be user adjustable.
3) The following is a list of key measurements required to be data logged:
a) Air Systems

Package Unit/Rooftop	Discharge Air Temperature
	Space Temperature Active
	Space Temperature Setpoint Active
	Cooling Capacity Status
	Heating Capacity Primary Status
	Outdoor Air Damper Position

Unit Heater	
	Space Temperature Active
	Space Temperature Setpoint Active

b) Area

Area	Active Setpoint
	Heat/Cool Mode Status
	Space Temperature Average
	Space Maximum Temperature
	Space Minimum Temperature
	Space Temperature Sensor

3. Alarm/Event Log.
a. Any object in the system shall be configurable to generate an alarm when transitioning in and out of a normal or fault state.
b. Any object in the system shall allow the alarm limits, warning limits, states, and reactions to be configured for each object in the system.
c. An alarm/event shall be capable of triggering any of the following actions:
1) Route the alarm/event to one or more alarm log.
a) The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself.
2) Route an e-mail message to an operator(s).
3) Log a data point(s) for a period of time.
4) Run a custom control program.
4. VAV System Coordination. Provide applications software to properly coordinate and control the VAV system to ensure equipment safety and minimize energy use. This application shall perform the following functions:
a. Startup and shutdown the air handler safely. Ensure the VAV boxes are open sufficiently when the air handler is running, to prevent damage to the ductwork and VAV boxes due to high air pressure.
b. Calibrate VAV boxes.
c. Fan Pressure Optimization (ASHRAE 90.1) - Minimize energy usage by controlling system static pressure to the lowest level while maintaining zone airflow requirements. System static pressure controlled to keep the “most open” zone damper between 65% and 75% open.
1) The Fan Pressure Optimization application shall have the ability to identify and display the discharge air setpoint of the air-handler and the VAV box that serves the critical zone (e.g., the zone with the most open VAV box damper). This information shall dynamically update with changes in the location of the critical zone.

2) During commissioning, and with the engineer/owner, the controls contractor shall confirm the performance of Fan Pressure Optimization by conducting a field functional test that demonstrates critical zone reset.

d. Ventilation Optimization (ASHRAE 62) – properly ventilate all spaces while minimizing operating energy costs, using measured outdoor air flow. Dynamically calculate the system outdoor air requirement based on “real time” conditions in the spaces (i.e., number of occupants, CO2 levels, etc.) minimizing the amount of unconditioned outdoor air that must be brought into the building.

e. Demand Controlled Ventilation – the active ventilation setpoint shall modulate between the occupied ventilation and occupied standby ventilation setpoint; Reset the setpoint based on CO2 levels in the space.

5. Point Control. User shall have the option to set the update interval, minimum on/off time, event notification, custom programming on change of events.
6. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, operator interface, or the local operator display. The amount of time that the override takes precedence will be selectable from the operator interface.
7. Anti-Short Cycling. All binary output points shall be protected from short cycling.

B. SYSTEM CONTROLLERS.

1. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in Application and Control Software section.
2. The System Controller shall have sufficient memory to support its operating system, database, and programming requirements.
3. The controller shall provide a USB communications port for connection to a PC.
4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
5. All System Controllers shall have a real time clock.
6. Data shall be shared between networked System Controllers.
7. The System Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
   a. Assume a predetermined failure mode.
   b. Generate an alarm notification.
   c. Create a retrievable file of the state of all applicable memory locations at the time of the failure.
   d. Automatically reset the System Controller to return to a normal operating mode.
8. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at -40 F to 122 F.
9. Clock Synchronization.
   a. All System Controllers shall be able to synchronize with a NTP server for automatic time synchronization.
   b. All System Controllers shall be able to accept a BACnet time synchronization command for automatic time synchronization.
   c. All System Controllers shall automatically adjust for daylight savings time if applicable.
10. Serviceability.
    a. Provide diagnostic LEDs for power, communications, and processor.
    b. The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
    c. All wiring connections shall be made to field removable, modular terminal connectors.
    d. The System controller shall utilize standard DIN mounting methods for installation and replacement.

11. Memory. The System Controller shall maintain all BIOS and programming information indefinitely without power to the System controller
12. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage.

PART 3 - EXECUTION

3.1 GENERAL

A. All electronic work required as an integral part of the Direct Digital Control system work is the responsibility of this section unless specifically indicated otherwise in this section, Section 23 09 13, or in Division 26.

B. This Contractor shall provide all labor, materials, engineering, software, permits, tools, checkout and certificates required to install a complete Direct Digital Control system as herein specified.

C. Any and all points added with this project shall be grouped for display purposes into the system such that all points associated with a new or existing DDC system can appear together on the CRT display or printed log. Assignment of points to a group shall not be restricted by hardware configuration of the points of direct digital control. It shall be possible to assign a point to appear in more than one system. An English descriptor and an alpha/numeric identifier shall identify each system.

D. This Direct Digital Control system as herein specified shall be fully integrated and completely installed by this section. It shall include all required computer CPU software and hardware. Include the engineering, installation, supervision, calibration, software programming, and checkout necessary for a fully operational system.

3.2 INSTALLATION

A. All work and materials are to conform in every detail to the rules and requirements of the National Electrical Code and present manufacturing standards. All wiring and cable installation shall conform with the wiring installation as specified in the installation section of Section 23 09 13. All material shall be UL approved.

B. Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details on drawings.

C. Line voltage wiring to power the DDC Controllers, not provided by the Division 26 Contractor, to be by this Contractor.

D. Control panels serving equipment fed by emergency power shall also be served by emergency power.

E. Provide uninterruptable power supplies where necessary to provide proper startup of equipment or to accomplish power restart control sequences specified.

F. Mount control panels adjacent to associated equipment on vibration-free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.

G. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

H. Cable tray routing of the communication trunks is acceptable.

I. All tubing, cable and individual wiring is to be permanently tagged, with numbers corresponding with "Record Drawings", spares are to be labeled as "Spare".

J. Provide technician to work with air balancing Contractor and/or provide balancing Contractor with necessary hardware to over-ride DDC controllers for air balancing and establishing differential pressure setpoints for air and water distribution systems. In addition, the control technician shall be present to calibrate air and water flow measuring stations.

K. Provide documentation to demonstrate that all points, input and output, have been checked out and verified operational, note any points not operating properly with notation of reason.

3.3 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 16 hours.

B. Provide two follow-up visits for troubleshooting and instruction, one six months after substantial completion and the other at the end of the warranty period. Length of each visit to be not less than 4 hours or the time necessary to provide required information and complete troubleshooting and inspection activity for all controls installed under 23 09 13, and 23 09 93. Coordinate the visit with the Owner/Agency and provide an inspection report to the Owner of any deficiencies found.

3.4 DEMONSTRATION TESTING

A. This Contractor shall include 8 hours for their technician to be on-site to demonstrate functionality of the following systems for the engineer of record:
   1. Air handling units.
   2. Boiler plants.
   3. Chiller plant.
   4. Hot and chilled water distribution systems.

END OF SECTION

SECTION 23 09 93 - SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 SCOPE

A. This section includes control sequences for HVAC equipment as well as equipment furnished by others that may need monitoring or control. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Description of Work.
      e. Submittals.
      f. Operation and Maintenance Data.
      g. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Not Applicable.
   3. PART 3 – EXECUTION.
      a. Control Sequences.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC - Coordination.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

D. Section 23 09 23 - Direct Digital Control System for HVAC.

E. Division 23 - HVAC - Equipment provided to be controlled or monitored.

F. Division 26 - Electrical - Equipment provided to be controlled or monitored.

G. Division 28 - Electronic Safety and Security.

1.3 REFERENCE

A. Section 23 09 13 work includes furnishing and installing all field devices, including electronic sensors for the DDC of this section, equipment, and all related field wiring, interlocking control wiring between equipment, pneumatic tubing, sensor mounting, etc., that is covered in that section.

B. Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators are also covered in Section 23 09 13.

1.4 DESCRIPTION OF WORK

A. Control sequences are hereby defined as the manner and method by which automatic controls function. Requirements for each type of operation are specified in this section.

B. Operation equipment, devices and system components required for automatic control systems are specified in other Division 23 control sections of these specifications.

C. All temperature, humidity, and pressure sensing, and all other control signal transportation for the control sequences shall be furnished under Section 23 09 13. All electronic, and electric

input/output signals shall be extended under Section 23 09 13 with adequate lead length for termination within the appropriate control panel being provided under 23 09 23.

D. Sequences for equipment controlled by Direct Digital Controls (DDC) as specified are accomplished by hardware and software provided under Section 23 09 23. Sequences for equipment controlled by electric self-contained controls are accomplished by hardware provided under Section 23 09 13.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures

B. Section 230500 and Sections 23 09 23 and 23 09 13 for descriptions of what should be included in the submittals.

C. Shop drawings shall be provided by Contractor(s) providing equipment under Sections 23 09 23 and 23 09 13. The Contractor providing the DDC equipment shall provide a complete narrative of the sequence of operations for equipment that is controlled through the DDC system. The Contractor providing the 23 09 13 equipment shall provide a complete narrative of the sequence of operation for equipment that is controlled directly from that equipment (without control logic through the DDC system). The narrative of the sequence of operation shall not be a verbatim copy of the sequences contained herein, but shall reflect the actual operation as applied by the Contractor.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:
   1. All final setpoints and terminal unit air flow correction factors (“K” factors) shall be documented on the as-built control drawings as determined by working in conjunction with the balancing Contractor.

1.7 DESIGN CRITERIA

A. Reference Section 23 09 13.

PART 2 - PRODUCTS

A. Not applicable to this Section – reference Sections 23 09 23 and 23 09 13 for product descriptions.

PART 3 - EXECUTION

3.1 CONTROL SEQUENCES

A. SETPOINTS:
   1. All setpoints indicated in the control specification are to be adjustable. The setpoints shall be readily available to be modified in the mechanical system software system summary (either textual or graphic based) and under the same software level as hardware points. Some less used setpoints may be provided on a lower software level, if requested by the Owner for clarity. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on requirements of the building. The control Contractor shall work with

the balancing Contractor and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use. Document all final setpoints on the as-built control drawings. Any questions regarding the intended operation of the HVAC equipment and control systems shall be referred to the HVAC design engineer through the appropriate construction communication process. The following setpoints should be used as initial setpoints unless otherwise specified in the individual control sequences:

a. Occupied Space Terminal Unit Heating: 68 °F.
b. Occupied Space Terminal Unit Cooling: 76 °F.
c. Entry Way Heating: 60 °F.
d. Mechanical or Unoccupied Space Ventilation: 82 °F.
e. Mechanical or Unoccupied Space Heating: 60 °F.

B. ANTI-CYCLING:

1. When HVAC equipment or a sequence is specified to be started and stopped by a temperature, humidity, pressure setpoint or any other controlled variable, there shall be an adjustable differential setpoint that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable. Temperature differential setpoints shall be set at 2 °F and non-temperature setpoints shall be set at 10% of the controlled range unless otherwise specified. Setpoints shall indicate at when the process should be turned on. Heating and cooling differentials shall be set for above setpoint and will be used to turn the process off. For example, an economizer sequence called to switch at 68 ºF, would turn on at 68 °F and off at 70 °F since it is a cooling function. A heating lockout setpoint of 50 ºF would turn on heating control at 50 °F and off at 52 °F Non-temperature differentials shall be set above setpoint if the setpoint is indicating a minimum value or below setpoint if the setpoint is indicating a maximum value. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Unless otherwise specified in the individual control sequences, fans and pumps shall have a minimum runtime on timers of 15 minutes (adj.) and off timers of 5 minutes (adj.). Safeties shall override runtime timers.

C. DEADBANDS:

1. Provide deadbands for all DDC control loops to prevent constant hunting of output signals to controlled devices. Deadbands shall be set to provide adequate control around setpoint as follows unless otherwise specified in the individual control sequences:
   a. Temperature Control: ±0.5 °F.
   b. Humidity Control: ±1% RH.
   c. Airflow Control: ±2% of total flow.
   d. AHU Static Pressure Control: ±0.01 in. w.c.

D. ALARMS:

1. Provide all alarmed points with adjustable time delays to prevent nuisance tripping under normal operation and on equipment start-up. Provide alarms on all points as indicated on point charts. For existing campus automations systems, add/delete what is called on the point charts for after consultation with user Owner to provide consistent alarming throughout the automation system.

E. EQUIPMENT START/STOP FAILURE STATES:

1. All start/stop points for equipment shall utilize normally open contacts unless called out specifically in the individual control sequences.

F. LEAD/LAG SEQUENCING:

1. For sequences that call for lead/lag of equipment connected to building automation systems, the lead device shall be able to be chosen through a selectable day of the week and time of day through the building automation system. Coordinate with the Owner for scheduling switchover and frequency. Unless otherwise directed, switchover shall occur at 10 A.M. Tuesday and shall rotate the lead device on a weekly cycle rotating through all

devices sequentially. For standalone lead/lag sequence controllers (non-DDC), the lead device shall be selected by a switch on the panel face.

G. VARIABLE FREQUENCY DRIVE (VFD) MOTOR RUN STATUS:
1. Use the VFD programmable relay dry contact output specified to be provided with the VFD under Section 23 051 4 to prove motor run status and detect belt loss or coupling break. If a bypass contactor is provided with the VFD, provide an adjustable current switch and wire it in parallel with the VFD output for proving motor status.

H. VFD MINIMUM SPEED:
1. The VFD start-up technician shall work with the Temperature Control Contractor to determine the minimum speed required for the motor controlled by the VFD to provide cooling of the motor as installed to prevent heat related problems. This minimum speed shall be set in the VFD controller.

I. CURRENT SWITCH SETUP:
1. When current switches are used for proving fan or pump status, they shall be set up so that they will detect belt or coupling loss by the reduction in current draw on loss of coupled load. The current switch set up shall be redone by the 23 09 13 Contractor after the balancer is complete.

J. DAMPER INTERLOCKS FOR FANS WITH STARTERS:
1. For fan systems with magnetic starters and shutoff dampers specified with end switches, the damper interlock shall be hardwired in such a way that the damper shall open if the fan starter hand / off / auto switch is in the hand or in the auto position and being called to start. After the damper end switch has proven the damper open, a hardwire interlock from the end switch to the starter holding coil for the fan shall cause the fan to start. For fan systems that are ducted in parallel, see specific sequence for fan system on interlock requirements.

K. DAMPER INTERLOCKS FOR FANS WITH VFD'S:
1. For fan systems with VFD's and shutoff dampers specified with end switches, the damper end switches shall be hardwire interlocked to the safety circuit(s) of the VFD to prevent the fan from starting until the damper is proven open. This interlock shall prevent the fan from running in either the VFD or bypass (if provided) mode. For fan systems that are ducted in parallel, see specific sequence for fan system on interlock requirements.

L. FAN INTERLOCKING:
1. Provide interlocks between supply and return or exhaust fan systems as scheduled on the plans or called out in individual control sequences. If DDC controlled, interlocks shall be done through DDC start/stop points unless otherwise specified in individual control sequences. If not DDC controlled, interlocks shall be accomplished via hardwire interlocks between fan starters or VFD's.

M. THERMOSTATS AND SENSORS:
1. All devices and equipment including terminal units, specified to be controlled in a control sequence by a thermostat or sensor, shall be provided with a thermostat or sensor, whether or not the device is indicated on the plans. Consult the HVAC design engineer for the thermostat or sensor location.

N. ORIGINAL EQUIPMENT MANUFACTURER (OEM) CONTROLLER DDC INTEGRATION:
1. Provide DDC programming to define all equipment integral input/output points, setpoints, data points, calculations, etc. that are available through the manufacturers communication interface. Consult with the Owner's DDC operations personnel to determine if some of the points should be omitted (for clarity or lack of value). The following equipment shall be integrated into the DDC system:
   a. Chillers.
   b. Chilled Water BTU Meters.
   c. Variable Frequency Drives.

d. Laboratory Fume Hood Control.
e. Computer Room Air Conditioners.
f. Lighting Control (furnished by Div 26).
g. Power Quality Meters (furnished by Div 26).

O. WEEKLY SCHEDULING:
1. Provide scheduling of DDC terminal units in groups based on occupancy. Work with the Owner to determine how many groups are required and which zones should be included. Individual terminal units shall be able to receive temporary schedules that will override the group schedules. Temporary override buttons at the zone sensor (where specified on point charts) shall override the scheduling to occupied. When groups that consist of more than 20% of terminal units are indexed to occupied, the associated air handling unit shall start if not already running.

P. CALCULATED DATA POINTS:
1. Provide calculated data points for actual dirty pressure drop for all variable volume air handling units with supply flow measurement based on the following equation:
a. Actual Dirty Filter ΔP = (Measured Supply CFM/Design CFM)^2 x Design Dirty Filter ΔP
2. Provide a calculated data point for outside airflow for all fans that have return and outside air mixing dampers and the points required to allow for the following equation:
a. Outside Airflow = Supply CFM x (MAT-RAT)/(OAT-RAT).
3. Where Supply CFM is measured either on variable volume fans or as balanced on constant volume units, MAT is Mixed Air Temperature, RAT is Return Air Temperature, and OAT is Outside Air Temperature. This point is designed as a check for outside air flow stations accuracy and outside air ventilation minimum damper positions. It should be noted that the accuracy of the calculated outside airflow will diminish as outside air temperature approaches return air temperature. It should be used as a check only when the RAT and OAT are greater than 20 °F and the accuracy of the RAT and OAT temperature sensors are assured.

3.2 OTHER EQUIPMENT

A. Refer to sheets M501 and M502 for additional sequencing information.

END OF SECTION

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SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for all duct systems used on this project. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Design Criteria.
      h. Delivery, Storage and Handling.
   2. PART 2 – PRODUCTS.
      a. General.
      b. Ductwork Pressure Class.
      c. Ductwork System Class.
      d. Materials.
      e. High Pressure Ductwork (Pressure class 3 inch and over).
      f. Low Pressure Ductwork (Maximum 2 inch pressure class).
      g. Kitchen Hood Exhaust Duct Construction.
      h. Dishwasher Exhaust Duct Construction.
      i. Exhaust Duct (Moisture laden air).
      j. Duct Sealant.
      k. Gaskets.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Ductwork Support.
      c. Low Pressure Duct (Maximum 2 inch pressure class).
      d. High Pressure Duct (Pressure class 3 inch and over).
      e. Kitchen Hood Exhaust Duct Construction.
      f. Exhaust Duct (Moisture laden air).
      g. Cleaning.
      h. Leakage Test.
      i. Structural Test.
   4. APPENDIX.
      a. Duct Leakage Test Report.
      b. Duct Structural Test Report.

1.2 RELATED WORK

A. Section 23 33 00 - Air Duct Accessories.

B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this Section.

1.4 REFERENCE STANDARDS

A.	ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties.
B.	ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
C.	ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
D.	ASTM A167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
E.	ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
F.	ASTM A527	Specification for General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
G.	ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method.
H.	ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation.
I.	ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation.
J.	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials.
K.	ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and Facings.
L.	ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
M.	ASTM C 916	Standard Specification for Adhesives for Duct Thermal Insulation NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
N.	UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors.
O.	NAIMA	Fibrous Glass Duct Liner Standard.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include manufacturer's data and/or Contractor data for the following:
   1. Fabrication and installation drawings.
   2. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
   3. Duct sealant and gasket material.
   4. Duct liner including data on thermal conductivity, air friction correction factor, and limitation on temperature and velocity.

1.7 DESIGN CRITERIA

A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:
1. HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.
2. HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.
3. HVAC Systems - Duct Design, 4th Edition, 2006.
4. Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004.
5. Round Industrial Duct Construction Standards, 2nd Edition, 1999.
6. Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995.

C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.8 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

B. Protect Ductwork against damage.

C. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging is provided, take precautions so caps/packaging remain in place and free from damage.

D. Offsite storage agreements do not relieve the Contractor from using proper storage techniques.

E. Storage and protection methods must allow inspection to verify products.

PART 2 - PRODUCTS

2.1 GENERAL

A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12” and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

B. Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.2 DUCTWORK PRESSURE CLASS

A. Minimum acceptable duct pressure class, for all ductwork is 2 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply duct upstream of VAV boxes	3 in. pressure class
Supply duct downstream of VAV terminals	2 in. pressure class
Transfer ducts	2 in. pressure class
Exhaust ducts	2 in. pressure class
Return ducts	2 in. pressure class
Relief ducts	2 in. pressure class

2.3 MATERIALS

A. Galvanized Steel Sheet:
   1. Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide “Paint Grip” finish for ductwork that will be painted.

B. Uncoated Black Steel Sheet:
   1. First quality, soft steel sheet capable of welding or double seaming without fracture.

C. Aluminum Sheet:
   1. Use ANSI/ASTM B209 aluminum sheet, alloy 3003H-14, capable of double seaming without fracture.

D. Prefabricated Grease Ducts:
   1. Dual wall construction with stainless steel inner liner, insulation and stainless steel (for exposed locations) or aluminized steel (for concealed locations) shell. Furnish all items which form a part of the assembly, including, tee sections, straight sections, elbows, end caps, cleanouts, expansion joints, fan/hood transitions, supports, flashing, counter flashing, and insulated roof thimble where required. Each section shall bear the factory applied Underwriters Laboratories Label.

2.4 HIGH PRESSURE DUCTWORK (PRESSURE CLASS 3 INCH AND OVER)

A. Manufacturers:
   1. Ajax.
   2. Semco: www.semcoinc.com.
   3. United Sheet Metal: www.unitedsheetmetal.com.
   4. Sheet Metal Connectors: www.smcduct.com.
   5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Machine formed round and/or flat oval spiral lock seam duct constructed of galvanized steel.

~~C.~~ Rectangular high pressure duct using a transverse joint system as manufactured by Ductmate, Nexus, TDC, TDF, or approved equal, may be used at Contractor's option. Duct to be flanged, gasketed and sealed.

D. Contractor fabricated ductwork meeting specified construction standards is acceptable with prior approval of Engineer. Submit construction details, a description of materials to be used, type of service, reinforcing methods, and sealing procedures.

E. Use a perforated inner liner on double wall high-pressure duct. Annular space between inner liner and outer duct to be filled with 1 inch glass fiber insulation.

F. Use cemented slip joints with 2 inch minimum overlap, flanged connections, or welded/brazed connections, unless noted otherwise for special applications. Prime coat welded joints.

G. Provide standard 90 degree conical tee takeoffs except for exhaust at velocities over 2000 feet per minute, use 45° lateral connections; straight taps or bullhead tees are not acceptable.

H. Internal bracing will not be accepted on ductwork below 48 inches.

I. Use turning vanes as specified in Section 23 33 00.

J. Provide bellmouth fittings or expanded fittings at each duct connection to air plenums.

K. Provide pressure relief fittings as indicated on the plans and/or details.

L. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

2.5 LOW PRESSURE DUCTWORK (MAXIMUM 2 INCH PRESSURE CLASS)

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

F. Button punch snaplock construction will not be accepted on aluminum ductwork.

G. Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of the Engineer.

H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.6 KITCHEN HOOD EXHAUST DUCT CONSTRUCTION

A. In concealed locations use minimum 16 gauge black steel or minimum 18 gauge stainless steel with all joints welded liquid tight or prefabricated grease duct, Underwriters Laboratory, Inc listed with aluminized steel shell

B. In exposed areas, use 18 gauge or heavier stainless steel with a number 3 finish and with all joints welded liquid tight or prefabricated Underwriters Laboratory, Inc listed duct with stainless steel shell. Grind and polish all welded joints and seams to a number 3 finish.

C. Provide expanded take-offs for branch duct connections or 45 degree entry fittings. Square edge 90 degree take-off fittings or straight taps will not be accepted.

D. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits shall be used wherever possible. Shorter radius elbows may be used in areas with limited space with prior approval of the Engineer.

E. No turning vanes may be used in kitchen exhaust duct.

F. Supporting steel and hangers shall not be lighter than the duct gauge.

2.7 DISHWASHER EXHAUST DUCT CONSTRUCTION

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as indicated below.

B. Use 18 gauge or heavier stainless steel with all seams and joints welded and ground smooth. In exposed areas, joints and seams are to be polished to #3 finish (minimum).

C. Use elbows and tees as specified for the appropriate duct pressure class.

D. Provide expanded take-offs for branch duct connections or 45 degree entry fittings. Square edge 90 degree take-off fittings or straight taps will not be accepted.

2.8 EXHAUST DUCT (MOISTURE LADEN AIR)

A. Moisture laden ductwork systems include showers and dishwashers.

B. Exhaust ducts conveying moisture laden air, other than dishwasher exhaust, to be constructed of sheet aluminum in accordance with SMACNA standards.

C. Seal all joints and seams watertight.

2.9 DUCT SEALANT

A. Manufacturer:
1. 3M 800: www.3m.com.
2. 3M 900: www.3m.com.
3. H.B. Fuller/Foster: www.hbfuller.com.
4. Hardcast: www.hardcast.com.
5. Hardcast Peal & Seal: www.hardcast.com.
6. Lockformer cold sealant: www.lockformer.com.
7. Mon-Eco Industries: www.mon-ecoindustries.com.
8. United Sheet Metal: www.unitedsheetmetal.com.
9. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Silicone sealants are not allowed in any type of ductwork installation.

C. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

2.10 GASKETS

A. 2 inch pressure class and lower:
1. Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

B. 3 inch pressure class and higher:
1. Butyl gaskets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

B. Make allowances for beams, pipes or other obstructions in building construction and for work of other Contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.

C. Test openings for test and balance work will be provided under Section 23 05 93.

D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

G. Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.

H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Provide adequate access to ductwork for cleaning purposes.

K. Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

L. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.

M. Install prefabricated grease ductwork assemblies in accordance with manufacturer requirements and NFPA 96.

N. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 DUCTWORK SUPPORT

A. Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.

B. Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

3.3 LOW PRESSURE DUCT (MAXIMUM 2 INCH PRESSURE CLASS)

A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws or pop rivets. Trapeze hangers may be used at Contractor's option.

3.4 HIGH PRESSURE DUCT (PRESSURE CLASS 3 INCH AND OVER)

A. Seal all duct in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

B. Single wall high pressure ductwork shall be installed as shown on the plans.

3.5 KITCHEN HOOD EXHAUST DUCT CONSTRUCTION

A. Where welded joints are used with black steel duct, coat all external welded joints and seams with paint. Grind and polish to #3 finish all exposed stainless steel joints and seams.

B. Apply bracing and reinforcement to the outside of the duct to prevent breathing, rattling, vibration or sagging of duct.

C. Install without forming dips, sag or traps which might collect residue by supporting at not greater than 5 foot intervals; fasteners at hangers shall not penetrate the duct. Do not use sheet metal screws on supports; use bolted, riveted or welded connections. Where ductwork is listed, install in accordance with listing.

D. Construct grease tight access doors of the same material and thickness as the duct and as large as possible, up to 24 inches in any dimension. Locate on duct sides for ease of inspection and cleaning at each change in direction, not less than every 10 lineal feet of duct, including risers, and not less than 1-1/2 inches from the bottom of the duct.

E. Insulation or fire protection enclosure shall be removable at each access door and clean out.

F. Pitch horizontal ducts back to hood at 1 inch per foot.

3.6 EXHAUST DUCT (MOISTURE LADEN AIR)

A. Pitch duct to drain back to equipment or exhaust grille.

B. Provide water tight drain pan at low points or at locations where moisture may collect. Pipe drain pan to nearest floor drain.

3.7 CLEANING

A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.8 LEAKAGE TEST

A. Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

C. Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

D. Leakage rate shall not exceed more that 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

E. Leakage test for ductwork downstream of air terminal devices may be omitted but will not relieve the Contractor from duct sealing requirements.

F. Submit a signed report to the Owner's Construction Representative, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

3.9 STRUCTURAL TEST

A. Random test all ductwork per Owner direction. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. Deflection limits shall not exceed those listed in accordance with Chapter 11 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.

C. Submit a signed report to the Owner's Construction Representative, indicating test apparatus used, results of the structural test, and any remedial work required.

END OF SECTION

DUCT LEAKAGE TEST REPORT

Project Number:_____

Date Submitted:_____

Project **Name:**_____

Location:_____

Contractor:_____

System Data

Fan No:_____ **Fan Design CFM:**_____

Leakage Class (C_L):_____

Duct Pressure Class (P_C):_____

Test Pressure (P_T):_____

Test Equipment

Manufacturer:_____ **Model No:**_____ **Serial No:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data					Field Test Data							
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft^2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM
TOTAL												

DUCT STRUCTURAL TEST REPORT

Project Number:_____

Date Submitted:_____

Project **Name:**_____

Location:_____

Contractor:_____

System Data **Fan No:**_____

Description of Test Method:_____

_____

_____

Test Equipment **Manufacturer:**_____ **Model No:**_____ **Serial No:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data								Field Test Data						
Duct Test Location	Ductwork Shape		Duct Pressure Class	Allowable Ductwork Wall Deflection		Allowable Joint/ Reinforcement Deflection		Pressure (in. wc.) In Duct	Measured Ductwork Wall Deflection		Measured Joint/ Reinforcement Deflection		Per-formed By/ Date	Wit-nessed By/ Date
	H	W		H	W	H	W		H	W	H	W		

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE

A. This section includes accessories used in the installation of duct systems. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Manual Volume Dampers.
      b. Turning Vanes.
      c. Fire Dampers.
      d. Control Dampers.
      e. Smoke Detectors.
      f. Access Doors.
      g. Flexible Duct.
      h. Flashings.
      i. Duct Flexible Connections.
      j. Sound Attenuators.
      k. Hoods for Intake and Exhaust.
      l. Louvers.
      m. Air Flow Stations.
   3. PART 3 – EXECUTION.
      a. Manual Volume Dampers.
      b. Turning Vanes.
      c. Fire Dampers.
      d. Control Dampers.
      e. Smoke Detectors.
      f. Access Doors.
      g. Flexible Duct.
      h. Flashings.
      i. Duct Flexible Connections.
      j. Sound Attenuators.
      k. Hoods for Intake and Exhaust.
      l. Louvers.
      m. Air Flow Stations.

1.2 RELATED WORK

A. Section 23 05 29 - Hanger and Supports for HVAC Piping and Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this Section.

1.4 REFERENCE STANDARDS

A. NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems.

B. SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.

C. UL 214 Standard for Factory-Made Air Ducts and Air Connectors.

D. UL 555 (6th edition) Standard for Fire Dampers and Ceiling Dampers.

E. UL 555S (4th edition) Leakage Rated Dampers for Use in Smoke Control Systems.

F. ACMA 610-10 Certified Ratings Program – Product Rating Manual for Airflow Measurement Stations.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

D. Submit manufacturer's color charts where finish color is specified to be selected by the Engineer.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

A. Manufacturers:
1. Ruskin: www.ruskin.com.
2. Vent Products: www.ventproducts.com.
3. Air Balance: www.airbalance.com.
4. Pottorff: www.pottorff.com.
5. United Enertech: www.unitedenertech.com.
6. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.2 TURNING VANES

A. Manufacturers:
1. Aero Dyne: www.aero-dyne.net.
2. Anemostat: www.anemostat.com.
3. Barber-Colman: www.barber-colman.com.
4. Hart & Cooley: www.hartandcooley.com.
5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 4-2 and Fig. 4-3 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 4-4 and Fig. 4-9.

2.3 FIRE DAMPERS

A. Manufacturers:
1. Air Balance: www.airbalance.com.
2. Advanced Air: www.advancedair.net.
3. American Warming and Ventilating: www.awv.com.
4. Greenheck: www.greenheck.com.
5. Phillips-Aire: www.drillspot.com.
6. Prefco: www.prefco-hvac.com.
7. Ruskin: www.ruskin.com.
8. Safe-Air: www.safe-air-corp.com.
9. Pottorff: www.pottorff.com.
10. United Enertech: www.unitedenertech.com.
11. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Static Fire Dampers:
1. Static fire damper assemblies must be UL 555 (6th edition) listed and labeled for static applications (where air systems do not operate during a fire) and meet requirements of NFPA 90A. Damper must be type B curtain type with blades out of the air stream; dampers with blades in the air stream will not be accepted. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

C. Dynamic Fire Dampers:
1. Dynamic fire damper assemblies must be UL 555 (6th edition) listed and labeled for dynamic applications (where air systems operate during a fire) and meet requirements of NFPA 90A. Dampers must be type B curtain type with curtain 100% out of air stream. Dampers larger than 30” by 30” or with velocity rating requirements of 3000 fpm or higher, may be multi-blade type with blades located in the airstream. Velocity ratings and static pressure ratings as indicated on the drawings. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

2.4 CONTROL DAMPERS

A. Control dampers are specified in section 23 09 13.

2.5 SMOKE DETECTORS

A. Smoke detectors are furnished and installed by the Electrical Contractor.

2.6 ACCESS DOORS

A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

B. Use insulated 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.7 FLEXIBLE DUCT

A. Manufacturers:
   1. Anco Products: www.ancoproductsinc.com.
   2. Clevaflex: www.clevaflex.com.
   3. Thermaflex: www.thermaflex.net.
   4. Flexmaster: www.flexmasterusa.com.
   5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and smoke developed rating of 50 or under in accordance with NFPA 90A.

C. Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

D. Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

E. Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.8 FLASHINGS

A. Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.

B. Flashing and counter flashing for roof curbs will be provided by others.

C. Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

2.9 DUCT FLEXIBLE CONNECTIONS

A. Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

B. Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

C. Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Hypalon, air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal weight of 26 ounces per square yard.

D. For corrosive environments or fume exhaust applications indoors or outdoors, use a material coated with Teflon that is air and water tight, suitable for temperatures between -20°F and 500°F, and has a nominal weight of 14 ounces per square yard.

2.10 SOUND ATTENUATORS

A. Manufacturers:
1. Industrial Acoustics Company: www.industrialacoustics.com.
2. Environmental Elements Corporation: www.environmentalemd.openfos.com.
3. Semco: www.semcoinc.com.
4. Dynasonics: www.dynasonics-acoustics.com.
5. United McGill: www.unitedmcgill.com.
6. VAW: www.vawsystems.com.
7. Ruskin: www.ruskin.com.
8. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Construct of a 22 gauge galvanized steel outer casing, and 26 gauge galvanized, perforated steel inner liner. Seams and joints of outer casing to be air tight.

C. Fill annular space between outer casing and inner liner with acoustic fill that is inert, inorganic, and of a density sufficient to obtain the specified acoustic performance. Material must meet requirements of NFPA 90A with a flame spread index of 25 or less and smoke developed rating of 50 or less.

D. Acoustical and aerodynamic performance is indicated on schedules on the drawings.

2.11 HOODS FOR INTAKE AND EXHAUST

A. Manufacturers:
1. Acme: www.acmefan.com.
2. Ammerman.
3. Carnes: www.carnes.com.
4. Cook: www.lorencook.com.
5. Greenheck: www.greenheck.com.
6. Louvers and Dampers: wwwlouvers-dampers.com.
7. Penn: www.pennstateind.com.
8. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Use low silhouette type hoods.

C. Use louvered penthouse type hoods with drainable blade louvers.

D. Construct hoods of aluminum.

E. Construct hoods of galvanized steel with baked enamel finish; color to be selected by the Architect during the submittal stage.

F. Provide bird screen and motor operated damper for each hood.

2.12 LOUVERS

A. Louvers are specified in the architectural section of these specifications.

B. Manufacturers:
1. Airolite; K6776: www.airolite.com.
2. Industrial Louvers; 658: www.industriallouvers.com.
3. American Warming and Ventilating; LE-31: www.awv.com.
4. Construction Specialties; 6177: www.c-sgroup.com.
5. Pottorff: www.pottorff.com.
6. United Enertech: www.unitedenertech.com.
7. Substitutions: Refer to Section 01 60 00 - Product Requirements.

C. Similar to Airolite Type K6776, extruded aluminum alloy not less than 12 gauge (.081" thick), 6063 series frame and blades, all-welded assembly, 35 degree or 45 degree blades with water baffle, 6 inches thick. Provide with bird screen of 1/2” x 1/2” mesh aluminum in 12 gauge aluminum frames and an aluminum sill. Locate the bird screen inside of the louver unless noted otherwise.

D. Louver to bear the AMCA certified ratings seal for both air performance and water penetration, having a free area not less than 50% based on a 48" x 48" section, a water penetration less than 0.1 oz/square foot under AMCA test at 1000 feet per minute, and an intake pressure drop less than 0.20 inches of water at 1000 feet per minute.

E. Finish to be anodized or Kynar 500 in a custom color to be selected by the Architect. Furnish sufficient paint in the same color as the louver to paint the outer surface of panels over unused portions of louvers and to paint the interior portion of ductwork visible through the louvers.

2.13 AIR FLOW STATIONS

A. Air flow stations are specified in section 23 09 13.

PART 3 - EXECUTION

3.1 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.2 TURNING VANES

A. Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

B. Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.3 FIRE DAMPERS

A. Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles on both sides of rated partition. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.

B. Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

3.4 CONTROL DAMPERS

A. Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

3.5 SMOKE DETECTORS

A. Installation and wiring of detectors will be by the Electrical Contractor. Install an access door at each detector location.

3.6 ACCESS DOORS

A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

3.7 FLEXIBLE DUCT

A. Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

B. Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheet metal screws and/or duct tape will not be accepted.

C. Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

E. Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

F. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.8 FLASHINGS

A. Flashing for roof curbs, equipment supports or rails located on roof will be installed by others.

3.9 DUCT FLEXIBLE CONNECTIONS

A. Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

B. For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon coated fabric when making the connector.

3.10 SOUND ATTENUATORS

A. Install sound attenuators in locations indicated on the drawings. Where modular installation is required, install units in a galvanized steel frame equipped with gaskets or seals between modules to prevent bypass of air.

3.11 HOODS FOR INTAKE AND EXHAUST

A. Install in locations indicated on the drawings, coordinating the roof opening location with the General Contractor. Curbs are covered in Section 23 05 29.

3.12 LOUVERS

A. Furnish louvers to the General Contractor for mounting in exterior walls. Connect outside air intake duct to the louver, sealing all connections air and water tight.

B. Provide bird screen on inside of active louver area where none is provided with louvers. Where louvers are equipped with inside bird screen, remove screen at all locations where duct connections are not made.

C. Install insulated metal panel on unused portion of louver. Panels must be sealed weather tight to louver assembly with flashing as required for proper drainage to outside of building. Paint outside surface of panel to match louver prior to installation. Where ductwork is visible through louver when viewed from outside the building, paint inside of duct to match louver color.

3.13 AIR FLOW STATIONS

A. Install where indicated on the drawings and/or as scheduled and in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for fans that are not an integral part of a manufactured device. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Operation and Maintenance Data.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. General.
      b. In-line Centrifugal Fans.
      c. Power Roof Exhaust Fans.
   3. PART 3 – EXECUTION.
      a. Installation.

1.2 RELATED WORK

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this Section.

1.4 REFERENCE STANDARDS

A. AMCA 203 - AMCA Fan Application Manual – Troubleshooting.

B. AMCA 210 - Laboratory Method of Testing Fans for Rating.

C. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

D. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. UL 762 - Power Roof Ventilators For Restaurant Exhaust Appliances.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.

C. Submit color selection charts for equipment where applicable.

D. Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

E. For variable air volume application, include data which indicates the effect of capacity control devices, such as inlet vanes, on performance.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.8 DESIGN CRITERIA

A. Tested and certify all fans in accordance with the applicable AMCA test code.

B. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

C. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.

D. Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.

E. All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.

F. All roof mounted equipment to be provided with curbs or equipment stands in accordance with specification in Section 23 05 29.

PART 2 - PRODUCTS

2.1 GENERAL

A. Use fan size, class, type, arrangement, and capacity as scheduled.

B. Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection.

C. Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.

D. Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

E. Statically and dynamically balance all fans so they operate without objectionable noise or vibration.

F. Use AMCA Type A spark resistant construction for all fans handling flammable or explosive vapors.

G. All fans handling grease laden vapors shall meet the requirements of UL 762 and NFPA 96.

H. Provide a corrosion resistant coating on all surfaces exposed to fume and other corrosive exhaust air. Coating to be as scheduled.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers:
1. Acme: www.acmefan.com.
2. PennBarry: www.pennbarry.com.
3. Cook: www.lorencook.com.
4. Greenheck: www.greenheck.com.
5. New York Blower: www.newyorkblower.com.
6. Peerless: www.peerlessblowers.com.
7. Penn: www.pennstateind.com.
8. Twin City: www.tcf.com.
9. Aerovent: www.aerovent.com.
10. Vent-A-Kiln:www.sheffield-pottery.com
11. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Construct housing of welded steel with reinforcing to prevent distortion. Furnish with streamlined inlet cones and multiple straightening vanes following the fan wheel to minimize noise and reduce turbulence. Provide each housing with a bolted and gasketed access door for inspection of drive and fan wheel. Use non-overloading airfoil blade fans welded to the wheel cones. Isolate belt drives from airstream with a belt tube. Externally mount motors on an adjustable base. Bearings to be grease lubricated, self-aligning ball bearing type with grease seal and external grease fitting. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation. Apply a second coat of paint to all exterior surfaces.

C. Design all vertically mounted fans to withstand the vertical thrust loads.

D. Provide variable inlet vanes for fans as scheduled. Vane bearings shall have grease fittings extended to an accessible location.

E. Provide one inch galvanized mesh inlet screens for fans without inlet ductwork.

2.3 SIDEWALL PROPELLER FANS

A. Manufacturers:
1. Greenheck: www.greenheck.com.
2. Penn: www.pennstateind.com.
3. ACME: www.acmefan.com.
4. Cook: www.lorencook.com.
5. Aerovent: www.aerovent.com.
6. Twin City Fan: www.tcf.com.
7. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Constructed of steel with angle iron reinforcing and motor support frame, die formed propeller blades with a welded reinforcing gusset on the backside for added rigidity, belt or drive as scheduled, 24 volt electrically operated **insulated** control damper with blade edge and jamb seals, damper operator, bird screen, and screened inlet/fan guard. Unless a special coating is

scheduled, paint fans with a prime coat after metal cleaning and surface preparation; apply a second coat of paint to all exterior surfaces.

C. Provide factory fabricated wall sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as shown on the drawings and as detailed, and according to manufacturer's installation instructions. On units provided with a drain connection, reduce drain connection down to 1/2 inch fitting and leave open.

B. Install thrust restraints in accordance with the requirements of Section 23 05 48.

C. Contractor shall balance blade assembly of destratification fans after installation to assure stable operation.

END OF SECTION

SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Submittals.
      g. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Round Ceiling Diffusers.
      c. Square Ceiling Diffusers - High Performance.
      d. Square Ceiling Diffusers – Plaque.
      e. Plenum Slot Diffusers - 180 Degree Adjustable.
      f. Side-Wall Registers and Grilles.
      g. Eggcrate Grille.
   3. PART 3 – EXECUTION.
      a. Installation.

1.2 RELATED WORK

A. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

B. Section 23 31 00 - HVAC Ducts and Casings.

C. Section 23 33 00 - Air Duct Accessories.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

B. UL 181 - Factory-Made Air Ducts and Connectors.

C. ARI-ADC Standard 880.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Furnish submittal information including, but not limited to, the following:
   1. Manufacturer's name and model number.
   2. Identification as referenced in the documents.
   3. Capacities/ratings.
   4. Materials of construction.
   5. Sound ratings.
   6. Dimensions.
   7. Finish.
   8. Color selection charts where applicable.
   9. Manufacturer's installation instructions.
   10. All other appropriate data.

1.7 DESIGN CRITERIA

A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carnes: www.carnes.com.

B. Krueger: www.krueger-hvac.com.

C. Titus: www.titus-hvac.com.

D. Metal-Aire: www.metalaire.com.

E. E.H. Price: www.price-hvac.com.

F. United Sheet Metal: www.unitedsheetmetalinc.com.

G. Tuttle & Bailey: www.tuttleandbailey.com.

H. Raymon Donco: www.raymon-hvac.com.

I. Substitutions: Refer to Section 01 60 00 - Product Requirements .

J. Acceptable manufacturers for specific products are listed under each item.

2.2 ROUND CEILING DIFFUSERS

A. Spun aluminum or steel with uniform 360 degree discharge pattern.

B. Adjustable inner cones surrounded by a ceiling plate collar designed to reduce ceiling smudges.

C. Diffusers as shown on drawings and/or as scheduled.

D. White, baked enamel finish or powder coat finish, unless otherwise indicated.

E. Manufacturers:
   1. Titus; Series TMRA: www.titus-hvac.com.
   2. Carnes; Series SSAA: www.carnes.com.
   3. Metal Aire; Series 3100: www.metalaire.com.
   4. Price; Series RCDA: www.price-hvac.com.
   5. Tuttle & Bailey: www.tuttleandbailey.com.
   6. Raymon Donco: www.raymon-hvac.com.
   7. Substitutions: Refer to Section 016000 - Product Requirements.

2.3 SQUARE CEILING DIFFUSERS - PLAQUE

A. Aluminum (Steel) unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

B. Directional blow pattern as shown on the drawings and/or as scheduled.

C. One-piece removable square face plaque with one-piece backpan.

D. White, baked enamel finish or powder coat finish, unless otherwise indicated.

E. Manufacturers:
1. Titus; Model OMNI: www.titus-hvac.com.
2. Carnes; Series SFPA/SHPA: www.carnes.com.
3. Price; Model SMDP: www.price-hvac.com.
4. Metal Aire; Series 5750: www.metalaire.com.
5. Krueger; Series PLQ/5PLQ: www.krueger-hvac.com.
6. Tuttle & Bailey: www.tuttleandbailey.com.
7. Raymon Donco: www.raymon-hvac.com.
8. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.4 SIDE-WALL REGISTERS AND GRILLES

A. Aluminum (Steel) unless otherwise indicated, with frame type appropriate to installation.

B. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

C. Opposed blade volume control damper supply registers, operable from face.

D. Fixed blade (0 degree, 45 degree) core return and exhaust registers and grilles.

E. Opposed blade volume control damper return registers, operable from face.

F. Register and grille sizes as shown on drawings and/or as scheduled.

G. White, baked enamel finish or powder coat finish, unless otherwise indicated.

H. Screw holes on surface counter sunk to accept recessed type screws.

I. Manufacturers:
1. Titus; Series 300 (supply) and series 350 (return/exhaust): www.titus-hvac.com.
2. Carnes; Model R series: www.carnes.com.
3. Price; Model 520 (Supply) Or 530 (return/exhaust): www.price-hvac.com.
4. Metal Aire; Series V4000 or H4000: www.metalaire.com.
5. Krueger; Series 880: www.krueger-hvac.com.
6. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.5 EGGCRATE GRILLE

A. Aluminum construction with frame type appropriate to installation.

B. Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area.

C. Grille sizes and finishes as shown on drawings and/or as scheduled.

D. White, baked enamel finish or powder coat finish, unless otherwise indicated.

E. Screw holes on surface counter sunk to accept recessed type screws.

F. Manufacturers:
1. Titus; Model 50: www.titus-hvac.com.
2. Carnes; Model RAE or RAT: www.carnes.com.
3. Price; Model 80: www.price-hvac.com.

4. Metal Aire; Model CC: www.metalaire.com.
5. Krueger; Model EGC: www.krueger-hvac.com.
6. Tuttle & Bailey: www.tuttleandbailey.com.
7. Raymon Donco: www.raymon-hvac.com.
8. Substitutions: Refer to Section 01 60 00 - Product Requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

B. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

C. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

D. Seal connections between ductwork drops and diffusers/grilles airtight.

E. Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.

F. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

END OF SECTION

SECTION 23 41 00 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for air system filters. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Operation and Maintenance Data.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Panel Filters.
      c. MERV 8 Filters.
      d. MERV 11 Filters.
      e. Housings for Panel Filters.
      f. Housings for MERV 8 Filters.
      g. Side Access Filter Housings.
      h. Filter Holding Frames.
      i. Filter Gauges.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Ulpa Filter Media.
      c. Filter Gauges.

1.2 RELATED WORK

A. Section 23 07 00 - HVAC Insulation.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. ASHRAE Standard 52.

B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.

C. UL 586 – Standard for High Efficiency Particulate Air Filter Units.

D. UL 900 – Standard for Air Filter Units.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SHOP DRAWINGS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include data concerning dimensions, materials, efficiencies, installation instructions and appropriate identification.

C. **Provide the follow-up paragraph or similar when the use of tested media is required. Test reports should be included in the shop drawings.**

D. Independent test reports verifying filter performance, test procedures and ratings.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.8 DESIGN CRITERIA

A. Use UL Class 1 or Class 2 filters unless noted otherwise. (Reference applicable UL standard referenced).

B. Efficiencies indicated in this section are based on ASHRAE Standard 52.

C. Fan motors have been selected to operate against the resistance of dirty filters as specified in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. American Air Filter: www.americanairfilter.com.

B. Barnebey-Cheney: www.genemco.com.

C. Cambridge: www.cambridgefilterusa.com.

D. Continental: www.continental-filters.co.za.

E. Flanders: www.flanderscorp.com.

F. Camil-Farr: www.camilfarr.com.

G. Mine Safety Appliances: www.msanet.com.

H. Research Products: www.research-products.com

I. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 PANEL FILTERS

A. Use 1" (or as scheduled) thick fiberglass blanket enclosed in a cardboard frame and reinforced with a perforated metal retainer on the air leaving side, Coat media with flameproof, non-volatile adhesive.

B. Media nominal rating to be 500 FPM face velocity, 0.15 inch WG initial resistance, 0.50 inches WG recommended final resistance. Average arrestance of filter media shall be 80%.

C. Provide filter holding frame.

2.3 MERV 8 FILTERS

A. Use 2" thick, pleated panels, 100% synthetic, self supported media fully bonded and sealed in cardboard frame.

B. Media nominal rating to be 500 FPM face velocity, 0.20 inch WG initial resistance, 1.0 inches WG recommended final resistance., Average arrestance of filter media shall be 90-92%

C. Furnish a side access housing or holding frame as scheduled.

D. Filter tracks shall be constructed to provide a minimum clearance of 2 inches between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.4 MERV 11 FILTERS

A. Use bag type, non-supported pockets, polypropylene media with synthetic backing scrim, fully bonded and sealed in a factory fabricated frame.

B. Media nominal rating to be 500 FPM face velocity, 0.35 inch WG initial resistance, 1.0 inches WG recommended final resistance.

C. Furnish a side access filter housing or holding frame as scheduled. Filter tracks shall be constructed to provide a minimum clearance of 2 inches between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.5 HOUSINGS FOR PANEL FILTERS

A. Manufactured by air handling unit manufacturer, filter media manufacturer, or Contractor fabricated. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed.

2.6 HOUSINGS FOR MERV 8 FILTERS

A. Housing or holding frame to be of the same manufacturer as filter media or provided by the air handling unit manufacturer. Contractor fabricated housings or filter racks will not be accepted. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed. Filter tracks shall be constructed to provide a minimum clearance of 2 inches between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.7 SIDE ACCESS FILTER HOUSINGS

A. Galvanized steel housing with aluminum or galvanized steel filter mounting tracks. Mounting tracks and access doors to have gaskets to minimize air bypass around the filters. Housing assembly to be suitable for use in duct systems based on design.

B. Standard filter sections provided by air handling unit manufacturers may be used for MERV 11 filters.

C. Insulate housings where adjacent duct or air handling apparatus is insulated. Insulation to be contained within a 2” thick, double wall steel panel and meet the requirements specified for adjacent duct or apparatus.

D. Furnish a door on each end of the housing to facilitate filter changing. Doors to be hinged and provided with lever handle latches to secure the door. Doors shall not be secured with nuts, bolts, wing nuts, or sheet metal screws.

E. Furnish housings for MERV 11 filters with a lever action sealing mechanism to secure media in tracks.

F. Include an integral prefilter track for installation of MERV 8 prefilters. Filter tracks shall be constructed to provide a minimum clearance of 2 inches between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.8 FILTER GAUGES

A. Manufacturers:
1. Dwyer: www.dwyer-inst.com.
2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Direct reading, 3-1/2 inch dial type, diaphragm actuated, in a metal case. Lettering shall be black figures on white background. Provide front recalibration adjustment.

C. Provide gauges with the following ranges:

Filter Type	Scale Range (inch W.G.)
Panel filters	0.0 to 0.5
MERV 8	0.0 to 1.0
MERV 11	0.0 to 2.0

D. Provide one gauge for each filter bank, suitable for flush or surface mounting. Include an air filter gauge accessory package consisting of mounting bracket, aluminum tubing, two static pressure tips, and vent valves for each gauge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Where air handling equipment is to be used for temporary heating or ventilation of a facility, do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.

B. Where air handling apparatus is used during the construction period, install new filter media prior to start of air balancing. Additionally, deliver one new set of media to the Owner prior to substantial completion.

C. Install units as shown on drawings and details according to manufacturer's instructions.

D. Reinforce filter holding frames per manufacturer's instructions.

E. Maintain necessary clearance for changing filters.

3.2 FILTER GAUGES

A. Install filter gauge static pressure tips upstream and downstream of filters. Mount gauge on outside of filter housing or filter plenum in accessible position outside of the unit housing, install tubing and gauge valves between gauge and sensor tips. Adjust and level each gauge.

END OF SECTION

SECTION 23 55 00 - FUEL-FIRED HEATERS

PART 1 - GENERAL

1.1 SCOPE

A. This section includes specifications for fuel-fired heaters. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Submittals.
      g. Operation and Maintenance Data.
      h. Warranty.
   2. PART 2 – PRODUCTS.
      a. Gas Fired Unit Heaters.
      b. Infrared Heating Devices.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Gas Fired Unit Heaters.
      c. Infrared Heating Devices.
      d. Owner Training.

1.2 RELATED WORK

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. AGA American Gas Association.

B. ANSI Z83.4 Direct Gas Fired Makeup Air Heaters.

C. ANSI Z83.6 Gas Fired Infrared Heaters.

D. GAMA Gas Appliance Manufacturers Association.

E. NEC National Electrical Code.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 40 00 - Quality Requirements.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.8 WARRANTY

A. Gas fired unit heaters heat exchangers warranted for five years. Remainder of unit heater components warranted for 1 year from startup.

B. Radiant heat tubes warranted against internal corrosion for 10 years. Remainder of infrared radiant heater components warranted for 1 year from date of startup.

C. Direct fired make-up air units warranted for 12 months from date of startup.

D. Indirect fired make-up air units warranted for 12 months from date of startup.

PART 2 - PRODUCTS

2.1 GAS FIRED UNIT HEATERS

A. Manufacturers:
1. Modine: www.modine.com.
2. Reznor: www.rezspec.com.
3. Sterling: www.sterlinghvac.com.
4. Trane: www.trane.com.
5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Horizontal discharge, direct vent sealed combustion type. AGA certified for use with natural gas. Minimum annual fuel utilization efficiency (A.F.U.E.) of 80. All wiring shall comply with the National Electrical Code.

C. Construct casing of cold rolled steel with baked enamel finish. Direct drive propeller type fan statically and dynamically balanced and including fan safety guard and adjustable vertical and horizontal louvers for control of air diffusion on discharge of unit. Aluminized steel burners, electronic spark ignition with electronic flame supervision and timed lockout control. Heavy gauge aluminized steel heat exchanger and factory installed induced draft blower for heat exchanger prepurge and combustion gas venting. Provide a hinged access panel on the bottom of the unit to access the burner or provide side access (pull out drawer) to burner assembly. Single point power connection. Unit must be approved for vertical or side wall venting.

D. Provide spark ignited intermittent pilot system with electronic flame supervision.

E. AGA gas controls, including manual main shut-off valve, 24 volt redundant combination gas control valve with 100 percent safety shut-off valve and main gas pressure regulator.

F. Provide fan controls and limit safety controls including but not limited to:
1. Pressure switch to verify combustion/exhaust gas airflow.
2. High limit controls.
3. Fan time delay to delay the fan start until the heat exchanger reaches a predetermined temperature and to allow the fan to operate, after burner shut down, to remove heat exchanger residual heat.

G. This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control transformer along with 24 v wall mounted thermostat. All wiring shall be in conduit in accordance with Division 26 - Electrical and comply with the NEC.

H. Provide an air inlet/vent termination assembly and threaded hanger connections.

2.2 INFRA-RED HEATING DEVICES

A. Manufacturers:
   1. Basis-of-Design: Schwank
   2. Approved Alternates:
      a. Roberts-Gordon (Co-Ray-Vac): www.rg-inc.com.
      b. Combustion Research Corp (Reflect-O-Ray): www.combustionresearch.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. The entire system shall be AGA certified “Gas Infrared Heaters” conforming to ANSI standard Z83.6. All wiring shall comply with the National Electrical Code.

C. System configuration and performance as indicated on the drawings and/or equipment schedules.

D. Overall system and sub-systems certified for use with natural gas, as indicated on the drawings. Each comprised of burner unit, outside air inlet, combustion pipe, radiant pipe, reflectors, support brackets, vacuum fan(s) (separate from burner unit), exhaust pipe, thermostats and safety controls. Provide gas regulator, automatic gas valves and safety interlocks on gas train.

E. Unit is to be non-condensing type.

F. Burner and associated controls shall include, direct spark ignition, electronic flame monitoring, “power on” and “burner on” indicator lights, 100% gas safety shutoff in case of ignition failure, pre purge and post purge of system and air flow switch to prove combustion air flow prior to firing burner.

G. The combustion pipe shall be constructed of 16 gauge aluminized steel for a minimum of 10 feet. The radiant pipe shall be constructed of spiral wound 22 gauge aluminized steel. Construct flexible connector between vacuum fan and pipe of stainless steel.

H. Direct drive 115 volt vacuum fan to exhaust all combustion gases to the outdoors.

I. Provide polished aluminum or polished stainless steel reflectors over all heat exchanger piping including elbows, u-bends and fittings.

J. Provide single point 115 volt power connection at burner unit. Vacuum fan power to be field wired to burner. (Power wiring by Division 26 - Electrical Contractor. Thermostat and control wiring by this Contractor).

K. Furnish a low voltage or 115 volt wall mounted thermostat. If low voltage is used then proved factory installed control transformer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units as detailed and according to the manufacturer’s installation instructions.

B. Pipe vents from gas regulator to outside (where regulators are provided).

C. Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote panels/thermostats and the gas fired item.

3.2 GAS FIRED UNIT HEATERS

A. Install units and connect gas, combustion air and vent piping as instructed by the manufacture and in compliance with applicable code requirements. Suspend from building structure to maintain headroom beneath units as indicated in Section 23 05 29. Connect combustion air and venting to outside of building as indicated on the drawings and terminate per the manufacturer's instructions.

3.3 INFRA-RED HEATING DEVICES

A. Suspend units from structure as indicated on the drawings, as instructed by the manufacturer and in compliance with applicable codes. Gas connections to burner shall be made with a flexible connector. Route combustion air and vent piping to outside as indicated on the drawings and terminate per the manufacturer’s instructions.

3.4 OWNER TRAINING

A. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 4 hours.

END OF SECTION

SECTION 23 74 13 - PACKAGED ROOFTOP UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Roof Top Unit.

B. Packaged Units on Grade.

C. Unit Controls.

1.2 RELATED REQUIREMENTS

A. Section 26 27 02 - Equipment Wiring Systems: Installation and wiring of thermostats and other controls components; wiring from unit terminal strip to remote panel.

B. Section 26 27 02 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ARI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2009.

1.4 PERFORMANCE REQUIREMENTS

A. Scheduled Performance:
   1. Cooling Capacity: ARI 210/240 test conditions.
   2. Cooling Capacity: 95 degrees F condenser ambient air.
   3. Sound Rating Numbers: ARI 270.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.8 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide a one (1) year parts and labor warranty.

C. Provide a five (5) year warranty to include coverage for refrigeration compressors.

D. Provide a ten (10) year warranty to include coverage for heat exchangers.

PART 2 - PRODUCTS

2.1 PACKAGED UNITS 10 TONS AND LESS

A. Manufacturers:
1. Basis of Design: Trane.
2. York.
3. JCI.
4. Daikin.
5. No Substitutions.

Minimum two stage cooling.

B. AIR CONDITIONING UNITS:
1. General: Roof mounted units having gas burner and electric refrigeration.
2. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
3. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26 27 02.

C. FABRICATION:
1. Casing Construction.
2. Zinc coated, heavy gauge, galvanized steel.
3. Weather-resistant baked enamel finish on phosphatized exterior surfaces.
4. Meets ASTM B117, 672 hour salt spray test.
5. Removable single side maintenance hinged access panels.
6. Base pan shall have no penetrations within the perimeter of the curb other than the raised 1-1/8 inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.
7. Base of the unit insulated with 1/8 inch, foil-faced, captured and sealed, closed-cell insulation.
8. Unit base provisions for forklift and/or crane lifting on three sides of unit

9. Supply and Return Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated. Isolate complete fan assembly. Refer to Section 220548.
10. Air Filters: 2 inch thick glass fiber disposable media in metal frames. MERV rating of 8.

D. NATURAL GAS HEATING:
1. Progressive tubular heat exchanger, stainless steel burners and corrosion resistant aluminized steel.
2. Induced draft combustion blower shall be used to pull the combustion products through the firing tubes.
3. Heater shall use a direct spark ignition (DSI) system.
4. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
5. Gas Valve: 2-Stages of Heat
6. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
7. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
8. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

E. EVAPORATOR COIL:
1. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.
2. Provide capillary tubes or thermostatic expansion valves for units of 6 ton capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 ton cooling capacity and larger.

F. REFRIGERATION SYSTEM:
1. Unit shall be factory charged with R-410A refrigerant.
2. Unit shall include two scroll compressors for a minimum of two stages of cooling capacity.
3. Compressors shall be scroll type with thermal overload protection, independently circuited and carry a 5 year non-prorated warranty.
4. Compressors shall be isolated from unit with the compressor manufacturer's recommended rubber vibration isolator, to reduce any transmission of noise from the compressor into the building area.
5. Provide with crankcase heaters.
6. Provide with frostat.
7. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
8. 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 side, and factory installed liquid line filter driers.
    a. Each capacity stage shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling.
    b. Each capacity stage shall be equipped with an adjustable, 20 second delay timer to prevent multiple capacity stages from starting all at once.
    c. Each refrigeration circuit shall be provided with an adjustable temperature sensor freeze stat which shuts down the cooling circuits when the evaporator coil tubing falls below the setpoint.

G. CONDENSER COIL:
1. Provide copper tube aluminum fin coil assembly with sub cooling rows and coil guard.

2. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.
3. Provide refrigerant pressure switches to cycle condenser fans.
4. Unit shall have low ambient cooling capability down to 0 degrees.

H. MIXED AIR CASING:
1. Dampers: Provide outside, return and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be gravity balanced.
2. Provide unit with 100% comparative enthalpy economizer with powered exhaust fan.
3. Provide unit with CO2 demand control ventilation with wall-mounted CO2 sensors.
4. Gaskets: Provide tight fitting dampers with edge gaskets maximum leakage 5 percent at 2 inches pressure differential.

I. OPERATING CONTROLS:
1. Unit shall have microprocessor controls.
2. Provide unit with factory-installed clogged filter switch and fan failure switch.
3. Unit shall have factory-mounted BACnet card and wireless communication interface.
4. Wireless display zone sensor shall be included with each unit.
5. Units to be integrated to Trane AirFi system. Provide necessary provisions for connection.

J. REQUIRED ACCESSORIES:
1. Louvered metal condenser coil hail guards.
2. Factory-installed circuit breakers.
3. Factory-installed powered convenience outlets.
4. 14” tall flat roof curbs.

2.2 50 TON PACKAGE UNITS

A. APPROVED MANUFACTURERS:
1. Basis of Design: Trane, Model: YCH600B4.
2. AAON, Model: RN-050-3-0-EA05-3D9.
3. Daikin, Model: MPS050FG.
4. York, Model: GZD2G030A3J.
5. No other substitutions.

B. GENERAL UNIT DESCRIPTION:
1. Unit(s) furnished and installed shall be packaged rooftop as scheduled on contract documents and these specifications. Cooling performance shall be based on AHRI testing procedures. Wiring internal to the unit shall be numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance with cULus for Central Cooling Air Conditioners. Unit(s) shall be factory assembled, internally wired, fully charged and consist of insulated weather tight casing with compressors, air cooled condenser coil, condenser fans, evaporator coil, filters, supply and/or exhaust motors and drives, unit controls, and natural gas heat.

2. Unit(s) shall be single piece construction as manufactured at the factory.

3. Unit shall be horizontal configuration, having both supply and return openings on the same side of the unit as shown on mechanical drawings. Achieving horizontal duct connections through the use of a transition curb is not acceptable.

4. Unit shall be mounted on a 14” tall factory-supplied roof curb.

5. Unit(s) shall be factory run tested to include the operation of all fans, compressors, heat exchangers, safeties, limits, and control sequences.

6. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

C. UNIT CASING:
1. Cabinet: Galvanized steel, phosphatized, and finished with pre-applied baked polyurethane enamel. Cabinet surface shall be tested 672 hours in salt spray in compliance with ASTM B117. Fully gasketed removable access panels. Structural members shall be heavy gauge with access doors and removable panels of heavy gauge. Provide foil faced fiberglass insulation on all exterior panels and roof in contact with the return and conditioned air stream. Cabinet top cover shall be one piece construction or where seams exits, it shall be double hemmed and gasket sealed.

2. Hinged Access Doors: Fully-gasketed hinged doors with hold-back apparatus shall provide access to filters, supply air fan section, evaporator coil section, and unit control .

D. ELECTRICAL POWER CONNECTIONS:
1. Unit shall include a phase monitor as standard that protects equipment from phase loss, phase reversal, and low voltage. Any fault condition shall produce a Failure Indicator LED, and send the unit into an emergency stop condition. The entire unit with this option shall be cULus approved. If not, a field UL inspection is required.

2. Unit shall include a factory-installed non-fused disconnect switch which satisfies NEC requirements for a service disconnect switch. Disconnect handle shall be accessible through the control box door such that high voltage power must be off before door can be opened.

3. Unit shall include factory-powered 115V convenience outlet capable of ground fault protection.

E. AIR FILTERS:
1. Air Filters: Filters shall mount integrally within unit and be accessible through hinged access panels. Filters shall be 2” thick MERV 8.

2. Provide factory-installed dirty filter switch.

F. FANS – SUPPLY:
1. Provide forward-curved fan mounted with fixed pitch sheave drive assembly. Complete fans assemblies shall be statically and dynamically balanced.

2. Fan shaft shall be mounted on grease lubricated ball bearings.

3. All motors shall be circuit breaker protected.

4. Provide EISA rated motors for supply and exhaust fans.

5. Provide fan with factory-mounted VFD to allow for single-zone VAV operation. Provide VFD with bypass.

6. Provide with fan failure switch.

G. NATURAL GAS HEATING:
1. Completely assembled and factory-installed heating system shall be integral to unit, cULus approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping connection through side of unit.

2. Heating section shall be factory run tested prior to shipment.

3. Gas Burner shall be forced combustion type power burner, negative pressure gas valve, manual shut-off, hot surface ignition, and flame sensing safety control.

4. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Upon a failure to ignite, three attempts of ignition will occur before lockout of the ignition system.

5. Combustion blower shall be centrifugal type fan with built-in thermal overload protection on fan motor.

6. Heat Exchanger: Provide drum and tube heat exchanger of free floating design manufactured from 14-gauge 304 stainless steel drum and 16-gauge 304 stainless steel tubes. Factory pressure and leak tested.

7. Gas Valve Type: Modulating.

8. Minimum Turndown Requirements: 5:1.

9. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

H. EVAPORATOR COIL:

1. Provide heavy duty aluminum fins mechanically bonded to internally enhanced, copper tubes.

2. Provide a thermostatic expansion valve for each refrigeration circuit. All coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil is pressure tested to 450 psig.

3. Provide with stainless steel drain pan.

4. Provide condensate overflow switch.

I. CONDENSER SECTION:

1. Provide all Aluminum Microchannel condenser coils. All condenser coils shall be leak tested at the factory to ensure pressure integrity and pressure tested to 650 psig.

2. Provide integral subcooling circuit(s) to prevent premature refrigerant flashing and to insure maximum operating efficiency.

3. Provide vertical discharge, direct drive fans with steel blades, and three phase motors. Fans shall be statically balanced. Motors shall be permanently lubricated, with built-in current and thermal overload protection in a weather tight casing.

4. Furnish unit with factory installed low ambient capability to allow for operation down to 0 F. Hot Gas Bypass shall not be acceptable.

5. Provide tool-less factory installed corrosion resistant metal louvered hail guards to protect condenser coils from hail or physical damage. Wire mesh coil guards shall not be acceptable.

J. REFRIGERATION SYSTEM:

1. R410A refrigerant.

2. Compressor(s) shall be manufactured by manufacturer of rooftop unit.

3. Compressor: Hermetic compliant scroll compressor operating at 3600 rpm with isolated mounting, centrifugal oil pump, and oil sight glass.

4. Provide factory installed service valves which include suction, liquid, and discharge 3-way shutoff valves.

5. Provide with thermostatic temperature motor winding control for protection against excessive temperatures caused by over/undervoltage operation or loss of charge. Also provide high and low pressure cutouts.

6. Provide integral coil frost protection based on refrigerant circuit suction temperature to prevent coil frosting with minimum energy usage for all units. Hot Gas Bypass shall not be acceptable.

7. Units shall have cooling capabilities down to 0 degree F as standard or manufacturer shall furnish unit with installed low ambient controls to allow for operation down to 0 degree F. For field installed low ambient accessory, the manufacturer shall provide a factory authorized serviceman that will assure proper installation and operation.

8. Provide a High Efficiency Unit (eStage) which shall provide 5 stages of mechanical cooling with the ability to be at or below 25% compressor displacement at stage one. Achieving this through Hot Gas Bypass shall be unacceptable. Achieving required turndown via variable speed compressor or digital scroll compressor is acceptable.

9. Provide unit with a modulating hot gas reheat option which shall consist of the following refrigeration components: a hot gas reheat coil, a cooling modulating valve, a reheat modulating valve, a reheat check valve, a reheat pump out solenoid, and additional interconnecting tubing.

10. Provide unit with wall-mounted humidity sensor.

K. EXHAUST/RETURN SECTION:

1. Modulating 100% Exhaust Fan with Statitrac Building Pressure Control Option shall include a differential pressure control system. Statitrac, shall use a differential pressure transducer to compare indoor building pressure to outdoor ambient atmospheric pressure and shall turn the exhaust fans on and off and modulate the barometric exhaust dampers to control the building pressure to within the adjustable, specified dead band that shall be adjustable at the RTVM board. Installing contractor shall install pressure tube from RTU to inside building.

2. Mechanical contractor is responsible for mounting air sensing tube into space for proper building pressure reading.

L. OUTDOOR AIR SECTION:

1. Provide a fully integrated factory installed 100% modulating outside air economizer with unit return and barometric relief air dampers. Economizer operation shall be through microprocessor based primary temperature controls that automatically modulate dampers to maintain space temperature conditions.

2. Provide economizer with comparative enthalpy control.

3. Provide with low-leak damper.

4. Provide adjustable minimum position control.

5. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

6. Provide wall mounted CO2 sensor to monitor space occupancy levels within the building by measuring the parts per million of CO2 (Carbon Dioxide) in the air. As CO2 levels increase, the economizer fresh air damper shall modulate to meet the CO2 space ventilation requirements.

M. UNIT CONTROLS:
1. General: Microprocessor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point and provides better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.
2. Variable Air Volume controls with Variable Frequency Drive: Provide variable air volume supply air temperature control with variable frequency drive with bypass. Provide all necessary controls to operate a VAV rooftop from supply air temperature including microprocessor controller and supply air sensor. The microprocessor shall coordinate the economizer control and stages of cooling with supply air temperature reset capability based upon space temperature. Variable frequency drive shall be factory installed and tested to provide supply fan motor speed modulation based upon the supply air static pressure setpoint.
3. The following setpoints shall be accessible in the unit control panel: supply air cooling setpoint, morning warmup setpoint, reset setpoint, reset amount, static pressure setpoint, and static pressure deadband.
4. Single Zone Variable Air Volume - Single Zone VAV option shall be provided with all necessary controls to operate a rooftop unit based on maintaining two temperature setpoints: discharge air and zone. Option shall include factory-installed variable frequency drive (VFD) to provide supply fan motor speed modulation. During One Zone VAV cooling, the unit will maintain zone cooling setpoint by modulating the supply fan speed more or less to meet zone load demand; and the unit will maintain discharge temperature to the discharge cooling setpoint by modulating economizer if available and staging dx cooling.
5. Provide unit with factory-installed clogged filter switch and fan failure switch.
6. Unit shall have factory-mounted BACnet card and wireless communication interface.
7. Wireless display zone sensor shall be included with each unit.
8. Units to be integrated to Trane AirFi system. Provide necessary provisions for connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level. Where unit is replacing an existing unit: provide a curb adapter.

D. Locate remote panels where indicated on drawings.

3.3 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

3.4 CLOSEOUT ACTIVITIES

A. Demonstrate operation to Owner's maintenance personnel.

3.5 MAINTENANCE

A. Provide service and maintenance of packaged roof top units for one year from Date of Substantial Completion.

B. Provide routine maintenance service with a two month interval as maximum time period between calls.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.

D. Provide 24-hour emergency service on breakdowns and malfunctions.

E. After each service call, submit copy of service call work order or report that includes description of work performed.

END OF SECTION

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SECTION 23 81 27 - SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor ductless fan & coil units.

C. Controls.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Indoor coil condensate drain.

B. Section 22 30 00 - Plumbing Equipment: Cooling condensate removal pumps.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats, humidistats, time clocks.

D. Section 23 31 00 - HVAC Ducts and Casings.

E. Section 26 27 02 - Equipment Wiring: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute; 2004.

D. AHRI 610 - Performance Rating of Central System Humidifiers for Residential Applications; Air Conditioning, Heating, and Refrigeration Institute; 2004.

E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010 (ANSI/ASHRAE Std 15).

F. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010.

G. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010, Including All Addenda (ANSI/AHSRAE/IESNA Std 90.1).

H. ASHRAE Std 90.2 - Energy-Efficient Design of New Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

I. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

K. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Project Record Documents: Record actual locations of components and connections.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

H. Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in Owner’s name and registered with manufacturer.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Filters: Two for each unit; of each type and size.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

1.6 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five manufacturer’s warranty for condensing units; compressors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Trane Inc: www.trane.com.

C. York International Corporation / Johnson Controls: www.york.com.

D. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
   1. Location: Ceiling; High-wall.

2. Sound Rating:
3. Cabinet: Galvanized steel.
    a. Finish: White.
4. Fan: Line-flow fan direct driven by a single motor.
5. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.
6. Wall-Mounted Units:
    a. Cooling Output: 24000 Btuh
7. Concealed Overhead Units:
    a. Cooling Output: 18000 Btuh

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
1. Construction and Ratings: In accordance with AHRI 210/240 and UL listed.
2. Manufacturer: System manufacturer.

2.3 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
1. Comply with AHRI 210.
2. Refrigerant: R-410A.
3. Cabinet: Galvanized steel with baked enamel; finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL listed.
5. Sound Rating: 69dBA, when measured in accordance with AHRI 270.

B. Compressor: AHRI 520, scroll, 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: ARI 520 Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
1. Condenser Fans: Direct-drive propeller type.
2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).

F. Operating Controls:
1. Control by room thermostat to maintain room temperature setting.
2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to 0 degrees F (-18 degrees C).

G. Mounting Pad: Precast concrete parking bumpers minimum of two located under cabinet feet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Pipe drain from cooling coils to nearest floor drain.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The electrical work included in all other Divisions is the responsibility of the Contractor performing the Division 26 work unless noted otherwise.

1.2 PROJECT OVERVIEW

A. Build electrical portion of new Canadian County Expo Center.

1.3 SCOPE

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
1. PART 1 – GENERAL.
    a. Project Overview.
    b. Scope.
    c. Related Work.
    d. Reference Standards.
    e. Regulatory Requirements.
    f. Quality Assurance.
    g. Protection of Finished Surfaces.
    h. Approved Electrical Testing Laboratories.
    i. Sleeves and Openings.
    j. Sealing and Firestopping.
    k. Intent.
    l. Omissions.
    m. Submittals.
    n. Project/Site Conditions.
    o. Work Sequence and Scheduling.
    p. Work by Other Trades.
    q. Offsite Storage.
    r. Request and Certificate for Payment.
    s. Certificates and Inspections.
    t. Operating and Maintenance Data.
    u. Record Drawings.
2. PART 2 – PRODUCTS.
    a. Access Panels and Doors.
    b. Identification.
    c. Sealing and Firestopping.
3. PART 3 – EXECUTION.
    a. Excavation and Backfill.
    b. Concrete Work.
    c. Cutting and Patching.
    d. Building Access.
    e. Equipment Access.
    f. Coordination.
    g. Sleeves.

h. Sealing and Firestopping.
i. Housekeeping and Clean Up.

1.4 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.5 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
1. ANSI American National Standards Institute.
2. ASTM American Society for Testing and Materials.
3. EPA Environmental Protection Agency.
4. ETL Electrical Testing Laboratories, Inc.
5. IEEE Institute of Electrical and Electronics Engineers.
6. IES Illuminating Engineering Society.
7. ISA Instrument Society of America.
8. NBS National Bureau of Standards.
9. NEC National Electric Code.
10. NEMA National Electrical Manufacturers Association.
11. NESC National Electrical Safety Code.
12. NFPA National Fire Protection Association.
13. UL Underwriters Laboratories Inc.

1.6 REGULATORY REQUIREMENTS

A. All work and materials are to conform in every detail to applicable rules and requirements of the State of Oklahoma Electrical Code the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

B. All Division 26 work shall be done under the direction of a currently certified State of Oklahoma Certified Master Electrician.

1.7 QUALITY ASSURANCE

A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.

B. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply. Where two or more manufacturers are specified and no reference is made to “or equal” other manufacturers, other manufacturers will be considered for prior approval with ten day prior approval submittals.

C. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by Owner, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

1.8 PROTECTION OF FINISHED SURFACES

A. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

1.9 APPROVED ELECTRICAL TESTING LABORATORIES

A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
   1. Underwriters Laboratories Inc.
   2. Electrical Testing Laboratories, Inc.

1.10 SLEEVES AND OPENINGS

A. Below Grade Wall Penetrations.

B. Conduit Penetrations.

1.11 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.12 INTENT

A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the Owner's intent (as determined by the Owner / Project Manager). Refer to the General Conditions of the Contract for further clarification.

C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Owner's and/or Architect/Engineer's inspections, tests and approval from the commencement until the acceptance of the completed work.

F. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

1.13 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Owner to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.14 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the Owner or Architect/Engineer, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

1.15 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner.

1.16 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate electrical schedule and operations with Owner's Construction Representatives.

1.17 WORK BY OTHER TRADES

A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.18 OFFSITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which the Owner will consider on a case by case basis. Prior approval by Owner personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.19 REQUEST AND CERTIFICATE FOR PAYMENT

A. Refer to the General Conditions for all payment request requirements.

1.20 CERTIFICATES AND INSPECTIONS

A. Refer to the General Conditions for Certificates and Inspections.

B. This Contractor is responsible for coordination of Owner electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this Contractor and the Electrical Inspector having jurisdiction.

1.21 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data, supply the following additional documentation:
1. Manufacturer's wiring diagrams for electrically powered equipment.
2. Provide 'As Built' drawings for owners records.
3. Per Owner Request, provide locates and site plan 'as built' for below grade electrical.

1.22 RECORD DRAWINGS

A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

B. The Owner or Engineer will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.

C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.

D. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner prior to final payment.

PART 2 - PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are sufficient; no additional access provisions are required unless specifically indicated.

B. Concealed Spline Ceilings:
1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under other divisions.

C. Metal Pan Ceilings:
1. Removable sections of ceiling tile held in position by pressure fit will be provided under other divisions.

D. Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A. See Electrical Section 26 05 53 – Identification for Electrical Systems.

2.3 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
   1. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.

B. Manufacturers:
   1. 3M: www.3m.com.
   2. STI/SpecSeal: www.stifirestop.com.
   3. Tremco: www.tremcosealants.com.
   4. Hilti: www.hilti.com.
   5. Substitutions: Refer to Section 01 60 00 - Product Requirements.

C. All firestopping systems shall be by the same manufacturer.

D. Submittals:
   1. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.
   2. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

E. Product:
   1. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.

F. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

G. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

H. Non-Rated Penetrations:
   1. Conduit Penetrations Through Below Grade Walls:
      a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
   2. Conduit and Cable Tray Penetrations:
      a. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated electrical systems installation. Blasting will not be allowed without written permission of the Owner.

3.2 CONCRETE WORK

A. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

B. Concrete work by EC does include transformer housekeeping pads, and utility transformer pad.

3.3 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements for Cutting and Patching.

3.4 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.5 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.6 COORDINATION

A. The Contractor shall cooperate with other trades and Owner's personnel in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.

C. Coordinate all work with other Contractors prior to installation. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

3.7 SLEEVES

A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

B. In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.

C. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

3.8 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.

B. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Surfaces:
   1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
   2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
   3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
   4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.9 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Submittals.
      e. Project Conditions.
   2. PART 2 – PRODUCTS.
      a. General.
      b. Building Wire.
      c. Variable Frequency Drive (VFD) Wire.
      d. Underground Wire for Exterior Work.
      e. Wiring Connectors.
   3. PART 3 – EXECUTION.
      a. General Wiring Methods.
      b. Wiring Installation In Raceways.
      c. Wiring Connections and Terminations.
      d. Field Quality Control.
      e. Wire Color.
      f. Branch Circuits.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

C. Section 26 05 53 – Identification for Electrical Systems.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submit product data: Provide for each cable assembly type.

C. Submit factory test reports: Indicate procedures and values obtained.

D. Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

E. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper.

2.2 BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.

C. Type XHHW-2 insulation for feeders with aluminum conductors.

2.3 VARIABLE FREQUENCY DRIVE (VFD) WIRE

A. All power wiring from the VFD output to the motor shall be type XHHW-2 insulation, single conductor wire.

2.4 UNDERGROUND WIRE FOR EXTERIOR WORK

A. Description: Stranded single or multiple conductor insulated wire.

B. Insulation: Type XHHW-2 or USE.

C. This wiring shall be used in all underground applications, except when run in a concrete-encased ductbank.

2.5 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps. Connector shall be irreversible type meeting IEEE Standard 837-2002, UL Listed.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

A. All wire and cable shall be installed in conduit.

B. Do not use wire smaller than 12 AWG for power and lighting circuits.

C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

D. Make conductor lengths for parallel conductors equal.

E. Splice only in junction or outlet boxes.

F. No conductor less than 10 AWG shall be installed in exterior underground conduit.

G. Identify ALL low voltage, 600v and lower, wire per Section 26 05 53.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

E. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.

3.3 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.

C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.
   1. Additional testing as follows shall be performed if aluminum conductors are used:
      a. Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.
      b. Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.
      c. Test procedures shall meet NETA guidelines.
      d. Test results and report shall be provided to the engineer.
      e. Contractor shall correct all deficiencies reported in the test report.

3.5 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
   2. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
   3. In existing facilities, use existing color scheme.
   4. In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.
   5. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.

B. Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.

C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.

E. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, Contractor shall provide green with yellow tracer.

3.6 BRANCH CIRCUITS

A. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

END OF SECTION

SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes furnishing and installing required remote control and signal cabling. Included are the following topics:
   1. PART 1 - GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Submittals.
      e. Project Conditions.
   2. PART 2 - PRODUCTS.
      a. General.
      b. Remote Control and Signal Cable.
      c. Wiring Connectors.
   3. PART 3 - EXECUTION.
      a. General Wiring Methods.
      b. Wiring Installation In Raceways.
      c. Wiring Connections and Terminations.
      d. Field Quality Control.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submit product data: Provide for each cable assembly type.

C. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper.

C. Insulation shall have a 600 volt rating.

D. All conductors must be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
   1. All conductors terminated with crimp type devices must be stranded.
   2. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2 REMOTE CONTROL AND SIGNAL CABLE

A. Refer to Section 28 31 00 for requirements for cable to be used on fire alarm systems.

B. All other systems cabling shall meet the requirements of NEC Article 725 and the following:
   1. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together, and covered with an overall PVC jacket. Cable shall be Listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.
   2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, Listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.3 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

A. Low voltage control and signal cables shall be installed in conduit. However, they may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in conduit in other sections of the specifications. See requirements for free-air cabling installation below.

B. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.

C. Splice only in junction boxes.

D. Identify wire per section 26 05 53.

E. Neatly train and lace wiring inside boxes, and equipment.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling conditions when necessary.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.3 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

D. Thoroughly clean wires before installing lugs and connectors.

E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

END OF SECTION

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding. Included are the following topics:

1. PART 1 - GENERAL.
   a. Scope.
   b. Related Work.
   c. References.
   d. Performance Requirements.
   e. Submittals.
   f. Project Record Documents.
   g. Regulatory Requirements.
2. PART 2 - PRODUCTS.
   a. Rod Electrode.
   b. Mechanical Connectors.
   c. Compression Connectors.
   d. Exothermic Connections.
   e. Wire.
   f. Bus.
3. PART 3 - EXECUTION.
   a. Examination.
   b. General.
   c. Less Than 600 Volt System Grounding.
   d. Field Quality Control.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

B. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 2 ohms maximum at building service entrance.

B. Testing of grounding system resistance is to be witnessed by the Engineer / Owner Representative. Provide test report of grounding system resistance in final O&M manuals.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground.

D. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 3/4 inch (19 mm) minimum.

C. Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

2.2 MECHANICAL CONNECTORS

A. The mechanical connector bodies shall be manufactured from high strength; high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are NOT allowed. Exception: The use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.3 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.4 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Cadweld: www.Cadweld.com.

B. Material: Stranded copper (aluminum not permitted).

C. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

D. Foundation Electrodes: As shown on drawings.

E. Primary Manhole, Main Switchgear room and Vault Bonding: No. 4/0 minimum.

F. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

2.5 BUS

A. Material: Copper (aluminum not permitted).

B. Size: 1/4" X 2" minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 GENERAL

A. Install Products in accordance with manufacturer's instructions.

B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.

C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.

D. Attach grounds permanently before permanent building service is energized.

E. All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.

3.3 LESS THAN 600 VOLT SYSTEM GROUNDING

A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building. In main service equipment area. Use effectively grounded metal frame of the building.

B. Provide code sized copper grounding electrode conductor from secondary switchboard ground bus, each separately derived system neutral, secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.

C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

D. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to under floor ground grid. Use #4 AWG bare copper conductor.

E. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.

F. Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.

G. Telecommunications and Audio Visual systems shall be installed with an isolated grounding system which has only one ground point. That ground point is to be the common grounding electrode system at the electrical service entrance for the building. Contractor is to provide an isolated grounding conductor from the electrical service entrance of the building to each Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room. Use a minimum No. 2/0 AWG copper conductor, or as indicated on the plans, for the telecommunications service grounding conductor. Leave 10 feet slack grounding conductor at each Telecommunications Room. The grounding conductor MUST NOT be attached to building steel (except as allowed at the main electrical service entrance).

H. Telecommunications Equipment Rack Grounding: Use a #6 or larger AWG copper conductor from all telecommunications cabinets and racks to the Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Quality Assurance.
   2. PART 2 – PRODUCTS.
      a. Material.
   3. PART 3 – EXECUTION.
      a. Installation.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for support channel.

1.4 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.

B. Hardware: Corrosion resistant.

C. Minimum sized threaded rod for supports shall be 3/8” for trapezes and single conduits 1-1/4” and larger, and 1/4” for single conduits 1” and smaller.

D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.

C. **Powder-actuated fasteners and plastic wall anchors are not permitted.**

D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.

F. Do not drill structural steel members unless approved by Owner.

G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch concrete pads.

I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall (7/8” Uni-strut or 3/4” painted, fire-retardant plywood is acceptable).

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes. Included are the following topics:
   1. PART 1 - GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
   2. PART 2 - PRODUCTS.
      a. Rigid Metal Conduit and Fittings.
      b. Intermediate Metal Conduit (IMC) and Fittings.
      c. Electrical Metallic Tubing (EMT) and Fittings.
      d. Flexible Metal Conduit and Fittings.
      e. Liquidtight Flexible Metal Conduit and Fittings.
      f. Rigid Nonmetallic Conduit and Fittings.
      g. Conduit Supports.
      h. Outlet Boxes.
      i. Floor Boxes.
      j. Pull and Junction Boxes.
      k. General.
   3. PART 3 - EXECUTION.
      a. Conduit Sizing, Arrangement and Support.
      b. Conduit Installation.
      c. Conduit Installation Schedule.
      d. Coordination of Box Locations.
      e. Outlet Box Installation.
      f. Floor Box Installation.
      g. Pull and Junction Box Installation.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 27 26 - Wiring Devices.

D. Section 26 27 02 - Equipment Wiring Systems.

E. Section 28 31 00 - Fire Detection and Alarm.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Surface Raceway System - submit product data and catalog sheets for all components.

C. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

C. diameter or two inches whichever is greater.

2.2 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

A. Conduit: Galvanized steel, threaded.

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Conduit: Steel, galvanized tubing.

B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.

C. Conduit Bodies: All steel threaded conduit bodies.

2.4 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Steel, galvanized, spiral strip.

B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 5113).

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.6 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90 ˚C conductors.

B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.7 CONDUIT SUPPORTS

A. See Section 26 05 29.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: Galvanized steel, with stamped knockouts.

B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

C. Concrete Ceiling Boxes: Concrete type.

D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.9 FLOOR BOXES

A. Floor Boxes for Installation in Cast-In-Place Concrete Floors must have quality metal covers.

2.10 PULL AND JUNCTION BOXES

A. Pull boxes and junction boxes shall be minimum 4 inch square by 2-1/8 inches deep for use with 1 inch conduit and smaller. On conduit systems using 1-1/4 inch conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4-11/16 inch square.

B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1-1/4 inch and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

C. Sheet Metal Boxes: Code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

D. Sheet Metal Boxes Larger than 12 inches in any dimension shall have a hinged cover or a chain installed between box and cover.

E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.

G. Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.

H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

I. Wireways shall not be used in lieu of junction boxes.

2.11 GENERAL

A. All steel fittings and conduit bodies shall be galvanized.

B. No cast metal or split-gland type fittings permitted.

C. Mogul-type condulets larger than 2 inch not permitted except as approved or detailed.

D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacturer.

E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.

F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. EMT is permitted to be used in sizes 4 inch and smaller for power and telecommunication systems.

B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch minimum except **all homerun conduits shall be 3/4 inch,** or as specified elsewhere. **Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.**

C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.

D. Arrange conduit to maintain headroom and present a neat appearance.

E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

F. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.

H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.

J. Support and fasten metal conduit at a maximum of 8 feet on center.

K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.

L. In general, all conduit shall be concealed except where noted on the drawings or approved by the Engineer. Contractor shall verify with Engineer all surface conduit installations except in mechanical rooms.

M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.

N. For indoor conduits, no continuous conduit run shall exceed 100 feet without a junction box.

O. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.2 CONDUIT INSTALLATION

A. Cut conduit square; de-burr cut ends.

B. Conduit shall not be fastened to the corrugated metal roof deck.

C. Bring conduit to the shoulder of fittings and couplings and fasten securely.

D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.

E. All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.

F. Install no more than the equivalent of three 90 degree bends between boxes.

G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.

H. Conduit shall be bent according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.

I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.

J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.

K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.

L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.

M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.

N. Route conduit through roof openings for piping and ductwork where possible.

O. Conduit is not permitted in any slab topping of two inches or less.

P. Ground and bond conduit under provisions of Section 26 05 26.

Q. PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) or up through a concrete floor.

R. Identify conduit under provisions of Section 26 05 53.

S. All conduit installed underground (exterior to building) shall be buried a minimum of 24 inches below finished grade, whether or not the conduit is concrete encased.

T. PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturer recommendations.

3.3 CONDUIT INSTALLATION SCHEDULE

A. Conduit other than that specified below for specific applications shall not be used.

B. Underground Installations within Five Feet of Foundation Wall: Rigid steel conduit.

C. Underground Installations More than Five Feet from Foundation Wall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.

D. Under Slab on Grade Installations: Schedule 40 PVC conduit.

E. Exposed Outdoor Locations: Rigid steel conduit.

F. Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit.

G. Within Concrete Slab: Rigid steel conduit.

H. Wet Interior Locations: Rigid steel conduit.

I. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

J. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

K. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot, maximum length shall be three feet. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

L. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8 inch minimum diameter and six foot maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

3.4 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.

D. Boxes shall not be fastened to the metal roof deck.

E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.

F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Engineer and install outlet as instructed by the Engineer.

G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.

H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch by 24 inch access doors.

I. Locate and install to maintain headroom and to present a neat appearance.

J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.5 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.

B. Power:
1. Recessed (1/4” maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

C. Provide knockout closures for unused openings.

D. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.

E. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.

F. Install boxes in walls without damaging wall insulation.

G. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

H. Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.

I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

J. 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.

K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

L. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

M. Surface wall outlets shall be 4 inch square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.6 FLOOR BOX INSTALLATION

A. Set boxes level and flush with finish flooring material.

3.7 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install Owner approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.

B. Support pull and junction boxes independent of conduit.

END OF SECTION

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes the products and execution requirements relating to labeling of power, lighting, general wiring, signal, fire alarm, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie & riser) cables, terminating equipment and labeling of inner duct (fiber optic). Included are the following topics:

1. PART 1 - GENERAL.
    a. Scope.
    b. Related Work.
    c. Submittals.
2. PART 2 - PRODUCTS.
    a. Materials.
3. PART 3 - EXECUTION.
    a. General.
    b. Junction and Pullbox Identification.
    c. Nameplate Engraving.
    d. Panelboard Directories.

1.2 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 23 - Control-Voltage Electrical Power Cables.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include schedule for nameplates and stenciling.

C. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8-1/2” x 11” sheets annotated, explaining their purposed use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: Back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.

B. Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

C. Nameplates: Engraved three layer laminated plastic, black letters on a white background. Emergency system (level 1 and level 2) shall use white letters on red background.

D. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.

E. Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16 inch and smaller junction boxes, fire alarm and control devices.

PART 3 - EXECUTION

3.1 GENERAL

A. Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.

B. All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.

C. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.

D. Install all labels firmly as recommended by the label manufacturer.

E. Labels shall be installed plumb and neatly on all equipment.

F. Install nameplates parallel to equipment lines.

G. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.

H. Embossed tape will not be permitted for any application.

3.2 JUNCTION AND PULLBOX IDENTIFICATION

A. The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Secondary Power – 480Y/277V	Brown
Secondary Power – 208Y/120V, 240/120V	White
Emergency Power – 480Y/277V	Brown/Red
Emergency Power – 208Y/120V	White/Red
Fire Alarm	Red
Sound and Intercom Systems	Blue

B. Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

3.3 NAMEPLATE ENGRAVING

A. Provide nameplates of minimum letter height as scheduled below.

B. Panelboards, Switchboards and Motor Control Centers: 1 inch; identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.

C. Equipment Enclosures: 1 inch; identify equipment designation.

D. Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch; identify circuit and load served, including location.

E. Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: 1/2 inch; identify source and load served.

F. Transformers: 1 inch; identify equipment designation. 1/2 inch; identify primary and secondary voltages, primary source, and secondary load and location.

G. Junction boxes: 1 inch; identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

3.4 PANELBOARD DIRECTORIES

A. Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

END OF SECTION

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SECTION 26 05 73 - SHORT CIRCUIT/COORDINATION STUDY AND ARC FLASH HAZARD STUDY

PART 1 - GENERAL

1.1 SCOPE

A. The Electrical Contractor shall retain the services of an independent third party firm to perform a short circuit/coordination study and arc flash hazard study as described herein.

B. The studies shall be submitted to the Design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

C. The studies shall include all portions of the electrical distribution system from the normal power source or sources, and emergency / standby sources, down to and including the smallest circuit breaker in the distribution system (for short circuit calculations). Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.

D. The firm should be currently involved in high and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer in the State of Oklahoma . Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Design Engineer for approval prior to start of the work. A minimum of five 5 years experience in power system analysis is required for the individual in charge of the project.

E. The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

F. The study and assessment shall be performed based on SKM’s Dapper, Captor and PowerTool software.

G. Included are the following topics:
1. PART 1 - GENERAL.
    a. Scope.
    b. Related Work.
    c. Quality Assurance.
    d. Data Collection for the Study.
    e. Submittals.
2. PART 2 - PRODUCTS.
    a. Not Used.
3. PART 3 - EXECUTION.
    a. Short Circuit and Coordination Study.
    b. Field Settings.
    c. Arc Flash Hazard Study.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 26 24 13 - Switchboards.

C. Section 26 24 16 - Panelboards.

1.3 QUALITY ASSURANCE

A. Reference standards listed in the *IEEE Recommended Practices for Protection and Coordination of Industrial and Commercial Power Systems* ("Buff Book"), latest edition.

1.4 DATA COLLECTION FOR THE STUDY

A. The Contractor shall provide the required data for preparation of the studies. The engineer performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.

B. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Third Party Qualifications:
   1. Submit qualifications of individual(s) who will perform the work to Design Engineer for approval prior to commencement of the studies.

C. Draft Report:
   1. Submit a draft of the study to Design Engineer for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.

D. Final Study Report:
   1. Provide studies in conjunction with equipment submittals to verify equipment ratings required.
   2. The results of the power system study shall be summarized in a final report. Six (6) bound copies of the final report shall be submitted. Provide two (2) copies in PDF format of the study, so that it can be more easily stored and shared. Also, provide 2 copies (on CD) of the report in MS word, and 2 copies (on CD) of the one-line diagram in CAD format.
   3. The report shall include the following sections:
      a. Overview.
      b. Short Circuit Study:
         SC-1 Purpose.
         SC-2 Explanation of Data.
         SC-3 Assumptions.
         SC-4 Analysis of Results.
         SC-5 Recommendations.
         SC-6 DAPPER Fault Analysis Input Report.
      c. Protective Device Coordination Study:
         PDC-1 Purpose.
         PDC-2 Explanation of Data.
         PDC-3 Assumptions.
         PDC-4 Analysis of Results.
         PDC-5 Recommendations (Including NEC 700-27 Requirement).
         PDC-6 CAPTOR Results.
         PDC-7 Example Drawings.
      d. Arc Flash Study:
         ARC-1 Purpose.
         ARC-2 Explanation of Data.
         ARC-3 Assumptions.
         ARC-4 Analysis of Results.
         ARC-5 Recommendations.

ARC-6 SKM Arc Flash Evaluation Report.

e. Prioritized Recommendations and Conclusions.

f. Appendices:

APP-1 DAPPER One-line Diagrams.
APP-2 AutoCAD One-line Diagrams.
APP-3 SKM Protective Device Summaries.
APP-4 Reference Data.
APP-5 Sample Work Permit Form.
APP-6 Copy of Warning Labels, including study date.

E. The above sections shall include the following items in detail:

1. Obtain available fault current from the local utility company.
2. Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.
3. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.
4. Recommendations for improving the coordination and/or load distribution, as well as ground fault requirements.
5. Arc flash values for two normal cases to define the highest values (low short circuit and high short circuit).
6. Arc flash values for two maintenance cases, which define the arc flash values available at the equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.
7. IEEE standard one-line diagram with equipment evaluation and circuit breaker setting forms that clearly define the system data and are easy to interpret.
8. Recommendations to reduce the arc flash incident energy in all areas that require class 2 and higher PPE.
9. Prioritized report summarizing all recommendations from this study. This shall include observed NEC code violations and their corrective action.
10. The Contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24” x 36” (minimum) Styrofoam backboard. This one-line diagram shall be mounted in each electrical room.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 SHORT CIRCUIT AND COORDINATION STUDY

A. The short circuit, coordination, and arc flash hazard studies shall be performed using SKM Dapper, Captor and PowerTool for Windows software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

B. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

C. Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

D. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

E. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

F. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

G. Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

H. Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not property rated for fault conditions.

I. Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.

J. When an emergency generator is provided, include phase and ground coordination of the generator protective devices, to meet NEC 700.27 requirements. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

K. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

L. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.

3.2 FIELD SETTINGS

A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device coordination study and arc flash hazard study.

B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

3.3 ARC FLASH HAZARD STUDY

A. As part of the short circuit and coordination study, arc flash hazard study shall be included. The study shall include the following:
   1. Determine and document all possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.
   2. Calculations to conform to National Fire Protection Association (NFPA) 70E – 2003 calculation standards. All incident energy units shall be calculated in calories per square centimeter.
   3. Provide recommended boundary zones and personal protective equipment (PPE) based on the calculated incident energy and requirements of NFPA 70E-2003 for each piece of electrical gear.

B. Electrical Contractor shall provide labeling as required by OSHA based upon the results of the arc flash hazard study. At a minimum, the labeling shall contain the following information: PPE level, Flash Hazard Boundaries, Flash Protection Boundary, and Shock Hazard Boundaries such as Limited Approach Boundary, Restricted Approach Boundary, Prohibited Approach Boundary, and study date.

END OF SECTION

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SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes dry type general purpose two winding transformers meeting the requirements of NEMA TP-1, and dry type isolation transformers. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Submittals.
      e. Operation and Maintenance Data.
      f. Delivery, Storage, and Handling.
   2. PART 2 – PRODUCTS.
      a. Dry Type General Purpose Two Winding Transformers.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Field Quality Control.
      c. Owner Training.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 REFERENCES

A. NEMA TP-1.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and protect equipment in a dry location with uniform temperature. Cover ventilating openings to keep out dust.

B. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D: www.squared.com.

B. Siemens: www.siemens.com.

C. General Electric: www.geindustrial.com.

D. Cutler Hammer: www.cutlerhammer.com.

E. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 DRY TYPE GENERAL PURPOSE TWO WINDING TRANSFORMERS

A. Dry Type General Purpose Transformers: Factory assembled, air cooled, dry type general purpose two winding transformers per NEMA-TP1; ratings as shown on the Drawings.

B. Transformers shall meet the energy efficiency standards of NEMA TP-1 and the DOE 'ENERGY STAR' label.

C. Transformer losses shall conform to NEMA TP-1 requirements.

D. Insulation system shall be rated at 220 degrees C.

E. Winding temperature rise shall be rated at 150 degrees C above a 40 degree C ambient.

F. Case temperature shall not exceed 50 degrees C rise above a 40 degrees C ambient at its warmest point.

G. Winding Taps, Transformers 15 KVA and Larger: Four 2-1/2 percent taps, two above and two below rated voltage, full capacity taps on primary winding.

H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap sized to meet NEMA and UL standards.

I. Coil Conductors: Continuous windings with termination pads brazed or welded.

J. Isolate core and coil from enclosure using vibration absorbing mounts.

K. Enclosure: NEMA Type 1. Provide lifting eyes or brackets.

L. Nameplate: Include transformer connection data.

M. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, 2 ft. minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

D. Provide sufficient space around transformer for cooling as recommended by the manufacturer.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments within 2-1/2% of the normal operating load after the building is in full operation.

END OF SECTION

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SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes main and/or distribution switchboard(s) specified herein and shown on the Drawings. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Submittals.
      e. Operation and Maintenance Data.
      f. Delivery, Storage, and Handling.
      g. Extra Materials.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Switchboard Construction and Ratings.
      c. Overcurrent Protective Devices.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Field Quality Control.
      c. Adjusting.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

1.3 REFERENCES

A. ANSI C57.13 - Instrument Transformers.

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA KS 1 - Enclosed Switches.

D. NEMA PB 2 - Dead Front Distribution Switchboards.

E. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

F. UL-891 - Dead Front Switchboards.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; one-line diagrams; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves and interrupting ratings of all equipment and components.

C. Submit the manufacturer provided coordination study and the overcurrent device set point recommendations to the consulting engineer for approval.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:
   a. Bus tightening intervals and procedures.
   b. Overcurrent protective device testing and maintenance procedures.
   c. Coordination study and the overcurrent device set point recommendations.
   d. Field report noting final adjustments to overcurrent protective device settings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 EXTRA MATERIALS

A. Submit one set of spare fuses of each size and type used in the equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D: www.squared.com.

B. Siemens: www.siemens.com.

C. General Electric: www.geindustrial.com.

D. Cutler Hammer: www.cutlerhammer.com.

2.2 SWITCHBOARD CONSTRUCTION AND RATINGS

A. Switchboard electrical rating and short circuit current rating shall be as shown on the Drawings.

B. Main Section Devices: Individually mounted.

C. Distribution Section Devices: Group-mounted and/or individually mounted, complete with bus in an integrated assembly. All breakers shall be bolted, quick-make, quick-break, trip indicating and common trip on all multi-pole breakers. No handle ties will be permitted.

D. Buses:
   1. The switchboard bussing (and all other current carrying parts such as fingers, neutral and ground buses) shall be plated copper. The bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements.
   2. For 4-wire systems, the neutral bus shall be the equivalent ampacity as the phase bus bars.
   3. Provide a copper ground bus through the length of the switchboard sized per UL 891 and NFPA requirements.
   4. Where spaces are indicated for future breakers, extend bus bars, drill and tap bus, and fully equip for the future breakers, including all connectors and mounting hardware.

E. Enclosure.
1. Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.
2. All closure plates shall be screw removable and small enough for easy handling by one person.
3. Finish: Manufacturer's standard medium gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
4. Enclosure shall be NEMA PB 2 Type 1 - General Purpose.

F. Pull Box: Same construction as switchboard, top and sides shall be removable.

G. Pull Section: Same construction as switchboard, width, depth and height to match switchboard.

H. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.

I. Provide metering transformer compartment for Utility Company's use. Compartment size, location, bus spacing and drilling, door, and locking and sealing requirements shall meet the requirements of the local utility company.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip elements in each pole.

B. Electronic Trip Circuit Breaker: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time trip and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.

2.4 COORDINATION OF OVERCURRENT PROTECTIVE DEVICES

A. The manufacturer shall perform a coordination study of the electrical system and recommend set points for all of the overcurrent and ground fault trip adjustments on the equipment provided. The coordination study and set point recommendations shall be submitted to the consulting engineer for approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

B. Install switchboard on a 3.5 inch high concrete equipment pad.

C. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.2 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

B. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.

C. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.

3.3 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Adjust trip and time delay settings to values as recommended in coordination study provided by manufacturer or as instructed by the Architect/Engineer. Include a copy of the coordination study and recommended circuit breaker set points in the O&M manual.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Operation and Maintenance Data.
      e. Spare Parts.
   2. PART 2 – PRODUCTS.
      a. Main and Distribution Panelboards.
      b. Branch Circuit Panelboards.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Field Quality Control.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.4 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.5 SPARE PARTS

A. Keys: Furnish 2 keys for each panelboard to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D: www.squared.com.

B. Siemens: www.siemens.com.

C. General Electric: www.geindustrial.com.

D. Cutler Hammer: www.cutlerhammer.com.

2.2 MAIN AND DISTRIBUTION PANELBOARDS

A. Panelboards: Circuit breaker type.

B. Enclosure: NEMA Type 1. Minimum cabinet size: 5-3/4 inches deep; 20 inches wide, with 5 inch minimum gutter space top and bottom. Constructed of galvanized code gauge steel.

C. Provide cabinet front with hinged door with flush lock. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

D. Provide metal directory holders with clear plastic covers.

E. Provide panelboards with copper bus (phase buses, bus fingers, etc., ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

F. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.

G. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

H. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.

B. Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches deep; 20 inches (508 mm) wide with 5 inch minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.

C. Provide flush or surface cabinet front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

D. Provide metal directory holders with clear plastic covers.

E. Provide panelboards with copper bus (phase buses, bus fingers, etc., ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

F. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.

G. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

H. Do not use tandem circuit breakers.

I. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

J. All of the panelboards provided under this section shall be by the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See section 26 05 29 for support requirements.

B. Install panelboards plumb with wall finishes.

C. Height: 6 feet to top.

D. Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

E. Provide filler plates for unused spaces in panelboards.

F. See section 26 05 53 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

G. Stub three (3) empty 3/4 inch conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

3.2 FIELD QUALITY CONTROL

A. If aluminum conductors size #1/0 and larger (per Section 26 05 19) are to be used as panelboard feeders, it is the responsibility of the Contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators to meet allowable code requirements. The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

END OF SECTION

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SECTION 26 27 02 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:
   1. HVAC motors, VFDs, and panels.
   2. Plumbing motors, VFDs, and panels.
   3. Elevators.
   4. Coolers & Freezers.
   5. Kitchen Equipment.

B. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Coordination.
   2. PART 2 – PRODUCTS.
      a. Cords and Caps.
      b. Other Products.
   3. PART 3 – EXECUTION.
      a. Inspection.
      b. Preparation.
      c. Installation.
      d. HVAC and Plumbing Connections.
      e. Elevator Connections.
      f. Cooler and Freezer Wiring.
      g. Kitchen Equipment Connections.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.
   1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for cord and wiring devices.

1.4 COORDINATION

A. Coordinate all equipment requirements with the various Contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

A. Straight-blade Attachment Plug: NEMA WD 1.

B. Locking-blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.2 OTHER PRODUCTS

A. Refer to related sections for other product requirements.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.

B. Make conduit connections to equipment using flexible PVC-coated metal conduit.

C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.

F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

G. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.4 HVAC AND PLUMBING CONNECTIONS

A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.

B. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.

C. Provide 120 volts to each temperature control panel. Coordinate requirements with HVAC/DDC Contractors.

D. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.

E. Each motor terminal box shall be connected with a minimum 12 inch, maximum 36 inch piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

F. Check for proper rotation of each motor.

3.5 ELEVATOR CONNECTIONS

A. Provide fused disconnect switch adjacent to elevator equipment room door. Locate on strike side of door. Provide one for each unit.

B. Provide all power wiring from source through disconnect to elevator controller to motor.

C. Provide manual starter labeled "lights" adjacent to power disconnect. Extend 120 volt circuit from source through lockable switch to controller. Provide one lockable switch and 120 volt circuit per unit.

D. Provide 3/4 inch conduit from controller to nearest telephone wiring closet with CAT-3 cable.

E. Provide smoke detector in each elevator equipment room or space. Connect main alarm contacts to fire alarm system and auxiliary contacts to the controller.

F. Provide all wiring for and mount exterior alarm bell. Feed from emergency source.

G. Provide smoke detector in each elevator lobby. Connect main alarm contacts to fire alarm system and auxiliary contacts to elevator controller.

H. Provide porcelain lampholder, 60 watt lamp and duplex receptacle 72 inches above elevator pit. Provide switch adjacent to access ladder, 36 inches above door sill. Provide 3-way switches, receptacle, lamp and lamp holder on every other floor above lowest level.

I. All traveling cables, control stations, control station wiring and final control connections at the controller shall be furnished and installed.

J. Coordinate entire installation with Elevator Contractor prior to rough-in.

3.6 COOLER AND FREEZER WIRING

A. Provide rigid conduit, IMC or PVC for all surface wiring in coolers and freezers. Whenever possible avoid the use of surface wiring and run conduit in space behind or above insulated panels.

B. Provide non-metallic nipple and sealing fittings whenever conduit pierces wall of cooler or freezer. Provide grounding conductor.

C. All openings cut in walls of cooler or freezer shall be patched and insulation integrity shall be maintained. Patching shall be approved by freezer or cooler installer.

D. Install all wiring for lighting, switches, evaporator, coil fans, compressors, interlocks, defrost heaters, door heaters, drain heaters, alarms, or any other electric devices supplied with unit.

E. Seal all conduits entering and leaving temperature-controlled areas.

3.7 KITCHEN EQUIPMENT CONNECTIONS

A. Check loose equipment delivered to job by equipment installer against approved shop drawings or other required Drawings. Loose electrical equipment including disconnects, starters, thermostats, controls, local and remote switches shall be furnished by Equipment Contractor and installed by Electrical Contractor.

B. Equipment Contractor will receive all equipment and position in place.

C. Equipment Contractor shall provide dimensioned equipment layouts, detailed shop drawings of equipment showing locations and method of installing loose equipment and making final connections, and wiring and control diagrams.

D. Electrical Contractor shall rough in for kitchen equipment only from approved kitchen equipment shop drawings.

E. Rough in location shall be within three inches of equipment. If direct connection is required, use liquidtight flexible conduit. If receptacle connection is required, verify proper receptacle configuration with equipment installer.

F. Final connections shall include extension of all service to each piece of equipment. All labor and material required to completely connect the equipment ready to operate shall be included in the final connections. All control wiring not integral with equipment shall be included.

G. Equipment Contractor shall provide services of their representatives and or equipment manufacturer's representative at appropriate stage of construction to answer the Contractor's questions concerning the final connections.

H. For kitchen exhaust hoods provide all required power and control wiring. This may include (but is not limited to) the following:
   1. Provide switch in hood and branch circuit for integral light fixtures.
   2. Provide pushbutton switch or manual starter for exhaust fan.
   3. Provide emergency branch circuit for fire suppression system. Wire automatic heat detectors or manual station so, when activated, valve of dry chemical bottle opens, gas solenoid valve shuts down, all dampers close, and make-up fans shut down, electrical power contactor opens (integral in equipment), and building fire alarm system is activated.
   4. Provide all required wiring conduit and final connections. Refer to wiring diagrams supplied with equipment.

I. Wire washdown system; refer to schematic wiring diagrams supplied with hoods. Interconnect fire prevention system with washdown system so washdown system is activated upon alarm.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through service fittings, access floor boxes, photo cells and time clocks. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Operation and Maintenance Data
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Wall Switches.
      c. Receptacles.
      d. Occupancy Sensors.
      e. Wall Dimmers.
      f. Device Plates and Box Covers.
      g. Poke-Through Fittings.
      h. Photo Cells.
      i. Time Clocks.
      j. Time Switch.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Field Quality Control.
      c. Occupancy Sensors.
      d. Adjusting.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

C. For occupancy sensor shop drawings, the manufacturer’s actual layout of occupancy sensors and the wiring diagrams shall be provided.

1.4 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cooper: www.cooperwiringdevices.com.

B. Hubbell: www.hubbell-wiring.com.

C. Pass and Seymour: www.passandseymour.com.

D. Leviton: www.leviton.com.

E. SensorSwitch: sensorswitch.com.
1. Note: SenorSwitch makes occupancy sensors and photocells, not outlets and toggle switches.

F. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 WALL SWITCHES

A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw.

B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.
1. Handle: Ivory made of nylon or high impact resistant material.

2.3 RECEPTACLES

A. Convenience and Straight-blade Receptacles: NEMA Type 5-20R, Ivory nylon or high impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Leviton model 5362, Hubbell model HBL5362, Pass & Seymour model 5362A, or Cooper model AH5362.

B. Generally, all receptacles shall be duplex convenience type unless otherwise noted.

C. All receptacles installed in outdoor locations, in garages, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.

D. GFCI Receptacles: Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and UL standard 498. GFCI receptacles shall be Leviton model 7899, Hubbell model GF20, Pass & Seymour model 2095, Cooper model VGF20 or approved equal.

E. All receptacles on emergency circuits shall have a red face.

F. All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.

2.4 OCCUPANCY SENSORS

A. All occupancy sensors shall be hardwired type; battery type shall not be permitted.

B. Wall Mounted (Wall Switch Type):
   1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.
   2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz.
   3. Sensitivity shall be user adjustable or self adjusting type.
   4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the Contractor in the field. The sensor shall have a test mode for performance testing.
   5. The off switch shall have manual override for positive off and automatic on.
   6. The test LED shall indicate motion.
   7. The area of coverage shall be approximately 180 degrees by 35-40 feet.
   8. The unit shall have a five year warranty.

C. Ceiling Mounted:
   1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
   2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.
   3. Sensitivity shall be user adjustable or self adjusting type.
   4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the Contractor in the field. The sensor shall have a test mode for performance testing.
   5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
   6. Test LED to indicate motion.
   7. The unit shall have a five year warranty.
   8. See drawings for actual type of sensor.

2.5 WALL DIMMERS

A. Wall Dimmers: Linear slide semiconductor type.

B. Suitable for LED Fixtures.

C. Rating: 600 Watts minimum, larger size to accommodate load shown on Contract Drawings.

2.6 DEVICE PLATES AND BOX COVERS

A. Decorative Cover Plate: 302/304 smooth stainless steel. Weatherproof Cover Plate: Gasketed metal with hinged device covers.

B. Surface Cover Plate: Raised galvanized steel.

2.7 PHOTO CELLS

A. The controller shall be rated 2000 watts tungsten at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1 inch diameter.

B. The enclosure shall be die cast zinc, gasketed for maximum weather proofing.

C. The enclosure shall include the positioning lug on the top of the enclosure.

D. The unit shall have a delay of up to two minutes to prevent false switching. ON/Off adjustment shall be done by moving a light selector with a range from 2 to 50 foot-candles.

E. Mounting shall be for a ½ inch conduit nipple.

F. The unit shall have a 5 year warranty.

G. The contacts shall be SPST normally closed.

H. The operational temperature range shall be -40 to 140 degrees F.

2.8 TIME CLOCKS

A. Unit shall be a multi-purpose, 7 day, 365 day advance single and skip a day, combination 2 channel electronic time clock with a SPDT switching configuration and astronomic dial.

B. The contacts shall be rated 10 amp resistive at 120/250 VAC, 7.5 amps inductive at 120/250 VAC, 5 amps inductive at 30 VDC and up to 1/2 hp at 250 VAC. The unit shall be rate for 30 VDC, 120 VAC, 250 VAC and 277 VAC.

C. The controller shall be capable of programming in the AM/PM or 24 hour format by jumper selection, in one minute resolution, using 2 buttons only for all basic settings.

D. Display shall be LED type.

E. The unit shall have 365 day and or holiday selection capabilities, with 16 single date and 5 holiday selection options and user selectable daylight savings/standard time functions.

F. The unit shall have 72 hour memory backup with rechargeable battery and charger.

G. The unit shall be capable of manual override, On and OFF to the next scheduled event, using 1 button for each channel.

H. The enclosure shall be rated for indoor or outdoor installation.

2.9 TIME SWITCH

A. The switch shall be programmed to automatically turn lights off after a preset time. The delay timer shall be adjustable with a range of 5 minutes to 12 hours.

B. Switch shall be rated for 120/277V, 1200W load.

C. The switch shall beep warning every 5 seconds during the last minute of countdown. Also, the switch shall flash lights (for warning) at one minute before timer expires.

D. Time scrolling shall be provided to override preset time by pressing the ON/OFF switch for four seconds.

E. LCD provided to show count down time.

F. The switch shall have zero crossing circuitry.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall switches 46 inches above floor to the center of device, OFF position down.

B. Install wall dimmers 46 inches above floor to the center of device; de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.

C. Install convenience receptacles 18 inches above floor, 6 inches above counters, backsplash, grounding pole on bottom.

D. Install box for information outlet 18 inches above finished floor. Install box for telephone jack for wall telephone 54 above finished floor.

E. Install specific-use receptacles at heights shown on Contract Drawings.

F. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

I. Install devices and wall plates flush and level.

J. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

3.2 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch and sensor with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Owner personnel reserve the right to be present at all tests.

3.3 OCCUPANCY SENSORS

A. Power packs used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.

B. Provide a minimum of 4 feet of coiled cable for ceiling-mounted sensors.

C. Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.

D. Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

E. For lights on emergency power without a remote transfer device, route the emergency circuit through a separate relay controlled by the occupancy sensor(s) in the respective area. For lights on emergency power with a remote transfer device, the emergency power does not get routed through the occupancy sensor relay, but the normal power does get routed through the occupancy sensor relay.

3.4 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

END OF SECTION

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SECTION 26 27 28 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Disconnect Switches.
      c. Fuses.
   3. PART 3 – EXECUTION.
      a. Installation.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

1.4 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D: www.squared.com.

B. Siemens: www.siemens.com.

C. General Electric: www.geindustrial.com.

D. Cutler Hammer: www.cutlerhammer.com.

2.2 DISCONNECT SWITCHES

A. Fusible Switch Assemblies (use only when overcurrent protection is required): NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R cartridge type fuses.

B. Nonfusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosure: NEMA Type 1 or as indicated on Drawings.

D. Provide manufacturer's equipment ground kit in all disconnect switches.

2.3 FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 250 or 600 volt, UL Class RK 1. Interrupting Rating: 200,000 rms amperes.

B. Fuses 601 Amperes and Larger: Time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.

C. Provide three (3) spares of each size and type fuse. Provide enclosure for spare fuse.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated on Drawings.

B. Provide identification as specified in Section 26 05 53.

END OF SECTION

SECTION 26 41 00 - FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 SCOPE

This section specifies the furnishing and installation of a complete UL master labeled lightning protection system.

1. PART 1 – GENERAL.
    a. Scope.
    b. Related Work.
    c. References.
    d. Submittals.
    e. Quality Assurance.
2. PART 2 – PRODUCTS.
    a. Materials.
3. PART 3 – EXECUTION.
    a. Installation.
    b. Acceptance checks and tests.

1.2 RELATED WORK

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults.

B. Section 26 43 13 – Surge Protective Devices for Low-Voltage Electrical Power Circuits: Surge protective device installed at the electrical service entrance.

1.3 REFERENCES

A. 96-05 Lightning Protection Components.

B. 96A-07 Installation Requirements for Lightning Protection Systems.

C. 467-07 Standard for Grounding and Bonding Equipment.

1.4 SUBMITTALS

A. Submit the following.
1. Shop Drawings:
    a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    b. Show locations of air terminals, connections to required metal surfaces, down conductors, and grounding means.
    c. Show the mounting hardware and materials used to attach air terminals and conductors to the structure.
2. Certifications: Two weeks prior to final inspection, submit the following.
    a. Certification by the manufacturer that the lightning protection system conforms to the requirements of the drawings and specifications.
    b. Certification by the Contractor that the lightning protection system has been properly installed and inspected.
    c. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Lightning protection components shall conform to NFPA 780 and UL 96.
1. Class I conductors: Copper.
2. Class I air terminals: Solid copper, (18 inches) long, not less than 9.5 mm (3/8 inch) diameter, with sharp bare nickel-plated points.
3. Ground rods: Copper-clad steel, 0.75 in (19 mm) diameter by 3 m (10 feet) long.
4. Ground plates: Solid copper, not less than 20 gauge.
5. Bonding plates: Bronze, 50 square cm (8 square inches).
6. Through roof connectors: Solid copper riser bar, length and type as required to accommodate roof structure and flashing requirements.
7. Down conductor guards: Stiff copper or brass.
8. Anchors and fasteners: Bronze bolt and clamp type shall be used for all applications except for membrane roof. Adhesive type are allowed only for attachment to membrane roof materials, using adhesive that is compatible with the membrane material.
9. Connectors: Bronze clamp-type connectors shall be used for roof conductor splices, and the connection of the roof conductor to air terminals and bonding plates. Crimp-type connectors are not allowed.
10. Exothermic welds: Exothermic welds shall be used for splicing the roof conductor to the down conductors, splices of the down conductors, and for connection of the down conductors to ground rods, ground plates, and the ground ring.
11. Aluminum conductors and components allowed where required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be coordinated with the roofing manufacturer and installer.

B. Install the conductors as inconspicuously as practical.

C. Install the down conductors within the concealed cavity of exterior walls where practical. Run the down conductors to the exterior at elevations below the finished grade.

D. Where down conductors are subject to damage or are accessible near grade, protect with down conductor guards to 2.4 m (8 feet) above grade. Bond down conductors guards to down conductor at both ends.

E. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.

F. Install ground rods and ground plates not less than 600 mm (2 feet) deep and a distance not less than 900 mm (3 feet) nor more than 2.5 m (8 feet) from the nearest point of the structure.

G. Bond down conductors to metal main water piping where applicable.

H. Bond down conductors to building structural steel.

I. Connect roof conductors to all metallic projections and equipment above the roof as indicated on the drawings.

J. Connect exterior metal surfaces, located within 900 mm (3 feet) of the conductors, to the conductors to prevent flashovers.

K. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least a 200 mm (8 inches) radius and do not exceed 90 degrees.

L. Conductors shall be rigidly fastened every 900 mm (3 feet) along the roof and down to the building to ground.

M. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure.

N. Install air terminal bases, cable holders and other roof-system supporting means without piercing membrane or metal roofs.

O. Down conductors coursed on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 30 M (100 feet).

P. A counterpoise or ground ring, where shown, shall be of No. 1/0 copper cable having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm (2 feet) deep at a distance not less than 900 mm (3 feet) nor more than 2.5 M (8 feet) from the nearest point of the structure.

Q. On construction utilizing post tensioning systems to secure precast concrete sections, the post tension rods shall not be used as a path for lightning to ground.

R. Where shown, use the structural steel framework or reinforcing steel as the down conductor.
   1. Weld or bond the non-electrically continuous sections together and make them electrically continuous.
   2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
   3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18 m (60 foot) intervals.
   4. Install ground connections to earth at not more than 18 m (60 foot) intervals around the perimeter of the building.
   5. Weld or braze bonding plates to cleaned sections of the steel and connect the conductors to the plates.
   6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL 96A.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Test the ground resistance to earth by standard methods, and conform to the ground resistance requirements specified in Section 26 05 26, Grounding and Bonding for Electrical Systems.

B. A UL representative shall inspect the lightning protection system. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative.

END OF SECTION

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SECTION 26 43 13 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes Surge Protective Devices (SPD) as indicated on the project drawings and electrical diagrams. Included are the following topics:
   1. PART 1 - GENERAL
      a. Scope.
      b. Related Work.
      c. Reference Standards.
      d. Quality Assurance.
      e. Warranty.
      f. Submittals.
      g. Operation and Maintenance Data.
   2. PART 2 - PRODUCTS
      a. Surge Protective Devices.
   3. PART 3 - EXECUTION
      a. Installation.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 REFERENCE STANDARDS

A. UL 1449, Fourth Edition – Standard For Safety For Surge Protective Devices.

B. ANSI/IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage AC Power Circuits.

C. ANSI/IEEE C62.41.2 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

D. ANSI/IEEE C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.

E. IEEE C62.62 Standard Test Specification for Surge Protective Devices For Low-Voltage AC Power Circuits.

F. Military Standard 220B.

G. NFPA 70, NEC Article 285.

1.4 QUALITY ASSURANCE

A. The manufacturer shall have been in the Surge Protective Device industry for a minimum of 5 years.

1.5 WARRANTY

A. The manufacturer shall provide a 5 year warranty from the date of shipment of the SPD.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include all SPD data necessary to show device is in compliance with all product specifications. Include product data sheets which show the device dimensions, weight, connections, and mounting requirements, along with installation instructions.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICES

A. The SPD shall be listed in accordance with UL 1449, Third Edition. The product and ratings shall be included in the database of the UL.com web site.

B. The surge protective device (SPD) shall be designated a location Type 1 or Type 2 device intended for installation on the load side of the service equipment overcurrent device, including SPDs located at the branch panel.

C. The SPD shall be connected in parallel with the facility's electrical system.

D. The SPD shall be made up of metal oxide varistors (MOV's), or a combination of MOV's with selenium cells or silicon avalanche diodes, ensuring that all of the performance requirements are met. Gas tubes shall not be used.

E. The entire SPD shall be enclosed in a metal or ABS enclosure, NEMA rated for the location. SPDs at main service equipment shall be mounted outside the switchboard or panelboard (not integral to, or installed within the switchboard or panelboard). SPDs for branch panelboard (2^{nd} tier) locations may be mounted outside of, or integral to, the branch panelboard.

F. The SPD shall have a maximum continuous operating voltage (MCOV) rating not less than 115% of nominal voltage of the system it is protecting.

G. Protection Modes:
1. The SPD shall have line to neutral (L-N), line to ground (L-G), line to line (L-L) and neutral to ground (N-G) protection modes for grounded wye configured systems. For a delta configured system, the device shall have line to line (L-L) and line to ground (L-G) protection modes.

H. Voltage Protection Rating (VPR):
1. The UL 1449 Voltage Protection Rating (VPR) for the device shall not exceed the following:
   a. 208Y/120 volt applications: 900V L-N,L-G, N-G; 1200V L-L.
   b. 480Y/277 volt applications: 1200V L-N,L-G, N-G; 2000V L-L.
   c. 480 volt delta applications: 1800V L-G, 2000V L-L.

I. Nominal Discharge Current (In):
1. The SPD shall have a UL 1449 Nominal Discharge Current Rating (In) of not less than 20kA.

J. Short Circuit Current Rating (SCCR):
1. The SPD shall have a UL 1449 Short Circuit Current Rating (SCCR) of not less than 200kA.

K. Single Impulse Surge Current Rating:
   1. The single-pulse (8 X 20 microsecond waveform as specified in ANSI/IEEE Standard C62.41) surge current capacity shall not be less than the following:
      a. 150 kA per mode for service entrance, switchboard, and main distribution panel locations.
      b. 65 kA per mode for branch panelboard (2nd tier) locations.

L. Electrical Noise Filtering:
   1. The SPD shall contain an EMI/RFI noise filter with minimum attenuation of -50dB at 100 kHz, tested per MIL-STD-220B.

M. Each SPD shall include externally-mounted LED visual status indicators that indicate the on-line status of the unit, for each phase.

N. Each SPD shall be provided with audible diagnostic monitoring by way of audible alarm with on/off silence function.

O. Each SPD shall be provided with one set of NO/NC dry contracts for alarm conditions.

P. Approved Manufacturers:
   1. Advanced Protection Technologies: www.aptsurge.com.
   2. Mersen: www.mersen.com.
   3. Current Technologies: www.tnbpowersolutions.com/current_technology.
   4. Siemens: www.siemens.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install SPD units in accordance with manufacturer's written instructions, applicable requirements of NEC and NEMA standards, and recognized industry practices.

B. The SPD units shall be installed at the locations shown on the drawings, or as indicated in the one-line diagram. They shall be parallel-connected to, and located adjacent to the switchboard or panelboard being protected. Locate as close as practical to the bus, keeping lead length as short as possible (less than 5 feet preferred). SPDs shall be connected through a multi-pole circuit breaker or fused disconnect switch, not into main lugs. Circuit breaker or fused disconnect switch shall be 60A minimum for main service device, 30A minimum for branch panelboard device or as recommended by the manufacturer (whichever is larger). Use schedule 40 PVC conduit or metallic conduit between the SPD and the switchboard or panelboard as recommended by the manufacturer. Avoid sharp bends, excess length, and splices in the wires. Where possible, use a close-nippled connection with wires going directly to a circuit breaker within the switchboard or panelboard.

C. Setup and test per the manufacturer's recommendations.

END OF SECTION

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SECTION 26 51 13 - INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:
   1. PART 1 - GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference Standards.
      d. Definitions.
      e. Submittals.
      f. Operation and Maintenance Data.
      g. Extra Material.
   2. PART 2 - PRODUCTS.
      a. Interior Luminaires and Accessories.
      b. LED Luminaires.
   3. PART 3 - EXECUTION.
      a. Installation.
      b. Adjusting and Cleaning.
      c. Interface with Other Products.
      d. Field Quality Control.
      e. Luminaire Connections Including Master-Satellite.
      f. Construction Verification Items.
      g. Owner Training.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 26 27 26 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. RoHS - Restriction of Hazardous Substances. Council of the European Union (EC) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

B. LM-79-08 (or latest) - IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

C. LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

D. TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

E. NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.

1.4 DEFINITIONS

A. Driver - the power supply used to power LED luminaires, modules, or arrays.

B. L70, $L_{70,}$ or $L_{70\%}$ - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.

C. LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

D. LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.

C. For each luminaire type, submit luminaire information including catalog cuts with highlighted catalog numbers and required accessories:
   1. Luminaire:
      a. Manufacturer and catalog number.
      b. Type (identification) as indicated on the plans and schedule.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.7 EXTRA MATERIAL

A. Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the luminaire and are not separate components, then extra LED's are not required.

B. Provide one (1) LED driver of each type.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES

A. See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Luminaires manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated luminaires, and meet the intent of the design.

B. Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).

C. Provide luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

2.2 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
   1. Minimum Light Output.
   2. Zonal Lumen Requirements.

3. Minimum Luminaire Efficacy.
4. Minimum CRI.
5. L70 Lumen Maintenance.
6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

7. Additional requirements:
   a. Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
   b. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
   c. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
   d. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
   e. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
   f. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
   g. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
   h. Driver shall have a rated life of 50,000 hours, minimum.
   i. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
   j. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
   k. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
   l. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
   m. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
   n. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
   o. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
   p. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
   q. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
   r. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
   s. All luminaires shall be provided with knockouts for conduit connections.
   t. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
   u. Provide all of the following data on submittals:
      1) Delivered lumens.
      2) Input watts.
      3) Efficacy.
      4) Color rendering index.

8. LED Luminaires used for Emergency Egress Lighting:
   a. The failure of one LED shall not affect the operation of the remaining LEDs.
9. Emergency LED Luminaire Compatibility with Inverters:
   a. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.
10. Dimming:
    a. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
    b. LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or “popcorn effect”. “Popcorn effect” is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are compatible with specified ceiling type(s) prior to ordering luminaires.

B. Install in accordance with manufacturer’s instructions.

C. Install suspended luminaires using aircraft cable, or pendants supported from swivel hangers. Heavy duty chain supports may be used where indicated on the luminaire schedule. Provide aircraft cable, pendants, or chain lengths required to suspend luminaire at indicated height. All aircraft cables or pendant supported luminaires shall have an independent support to structure at all cable or pendant support locations. When chain is used, tie-wrap the luminaire whip to the chain.

D. Support luminaires larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.

E. Provide independent support for all luminaires over 50 lbs.

F. Locate ceiling luminaires as indicated on reflected ceiling plan.

G. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

H. The Contractor shall install luminaire supports as required. Luminaire installations with luminaires supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all luminaires adequately, providing extra steel work for the support of luminaires if required. Any components necessary for mounting luminaires shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.

I. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires.

J. Install recessed luminaires to permit removal from below.

K. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

L. Install code required hardware to secure recessed grid-supported luminaires in place.

M. Install wall mounted luminaires and exit signs at height as scheduled. Use pendants supported from swivel hangers in exposed ceiling/structure locations where necessary to mount exit signs at the specified height.

N. Install accessories furnished with each luminaire.

O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

P. Bond luminaires and metal accessories to branch circuit equipment grounding conductor.

Q. Install specified lamps in each luminaire and exit sign.

R. High-Bay or Low-Bay Luminaires: Use power hook hangers rated 500 pounds (225 kg) minimum and provide safety chain between ballast and structure. Also provide safety chain between reflector and ballast.

S. Dimmed luminaire circuits shall have separate neutrals.

T. Dimmed LED luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire so that the luminaires don't "glow" at the lowest dimmed setting. This shall be accomplished using a switch, relay, or some other means acceptable to Owner.

3.2 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Aim and adjust luminaires as indicated on Drawings or as directed by the Engineer.

C. Touch up luminaire finish at completion of work.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Interface with air handling accessories furnished and installed under Division 23.

B. Provide controls as indicated on the plans. Refer to section 26 27 26 - Wiring Devices. Controls shall be compatible with the luminaires/ballasts/drivers being installed.

3.4 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.5 LUMINAIRE CONNECTIONS INCLUDING MASTER-SATELLITE

A. Provide direct box or conduit connections for surface mounted and recessed luminaires. Use a luminaire fixture whip from a J-box for recessed lay-in luminaires. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Cable/Conduit whips shall be 3/8" (10 mm) minimum diameter and six foot (1.8 m) maximum length. Flexible whips between master and satellite luminaires may be supported off of the ceiling grid wires. Cable/conduit whip length shall allow movement of the luminaire for maintenance purposes. Flexible metal conduit shall not be used for connections to luminaires where the conduit is exposed in finished spaces.

B. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite unit.

3.6 CONSTRUCTION VERIFICATION

A. Contractor is responsible for utilizing the construction verification checklists supplied in accordance with the procedures defined for construction verification checklists.

3.7 OWNER TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified under Division 1.

END OF SECTION

SECTION 26 51 15 - LOW VOLTAGE LIGHTING CONTROL

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes power supplies, control equipment, enclosures and switches associated with low voltage lighting control. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Record Documents.
      e. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Manufacturers
      b. Components.
   3. PART 3 – EXECUTION.
      a. Examination.
      b. Installation.
      c. Construction Verification Items.
      d. Functional Performance Testing.
      e. Owner Training.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Submit product data indicating system and component construction, ratings, and operating parameters.

C. Submit manufacturer's installation instructions.

1.4 RECORD DOCUMENTS

A. Accurately record location of switches, power supplies, and control enclosures. Include description of switching and circuiting arrangements.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lithonia: www.lithionia.com.

B. Douglas Lighting Controls: www.douglaslightingcontrol.com.

C. WattStopper: www.wattstopper.com.

D. Substitutions: Refer to Section 01 60 00 – Products Requirements.

2.2 COMPONENTS

A. Power Supply: ANSI/NFPA 70; Class 2 energy limited. 277 /24 volt transformer, rated 75 VA momentary, 40 VA continuous, with silicon rectifier rated 20 amperes intermittent, 7.5 amperes continuous, 30 VAC.

B. Low Voltage Relays: Heavy duty, two-coil momentary contact type remote control relays with contacts rated 20 amperes at 277 volts and with isolated and non-isolated pilot contacts where indicated. Include clamp type screw terminals for line voltage connections.

C. Switches: Momentary contact, three position switches, toggle type, White (Verify with Owner) color, rated 20 amperes at 120 VAC red.

D. Key Switches: Match non-key switch.

E. Switch Plates: Per section 26 27 26.

F. Master Selector Switch: Capabilities with control of up to thirty-two relay outputs. Switch control shall be microprocessor based with two independent inputs and provide master group control, master switch leg extension and maintained to momentary input conversion.

G. Remote Control Interface: System shall be able to operate with remote input on an individual local switching basis.

H. Cabinets and Enclosures: Shop fabricated and wired. Include appropriate barrier strips for mounting relays and separating energy- limited wiring from line voltage wiring. Include knockouts for relay mounting. Include space for ten percent minimum additional relays and one additional power supply in each cabinet and enclosure.

I. The entire system shall interface with existing/new building automation system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions are as shown on Drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use 20 AWG copper conductor building wire in conduit for low voltage wiring.

3.3 CONSTRUCTION VERIFICATION ITEMS

A. Contractor is responsible for utilizing the construction verification checklists supplied in accordance with the procedures defined for construction verification checklists.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. Contractor is responsible for utilizing the functional performance test procedures supplied in accordance with the procedures defined for functional performance test procedures.

3.5 OWNER TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified.

END OF SECTION

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SECTION 26 56 29 - SITE LIGHTING

PART 1 - GENERAL

1.1 SCOPE

A. The work under this section includes exterior luminaires and accessories, poles, and foundations. This includes building-mounted exterior lighting. Also included are the following topics:
   1. PART 1 - GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference Standards.
      d. Definitions.
      e. System Description.
      f. Submittals.
      g. Project Record Documents.
      h. Operation and Maintenance Data.
      i. Coordination.
      j. Extra Material.
   2. PART 2 - PRODUCTS.
      a. Luminaires.
      b. LED Luminaires.
      c. Fuses.
      d. Poles.
      e. Foundations.
   3. PART 3 - EXECUTION.
      a. Installation.
      b. Field Quality Control.
      c. Adjusting.
      d. Cleaning.
      e. Construction Verification Items.
      f. Owner Training.

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.3 REFERENCE STANDARDS

A. SPS 362.1807 Shallow Post Foundations.

B. IBC 1807.3 Embedded Posts and Poles.

C. RoHS - Restriction of Hazardous Substances. Council of the European Union (EC) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

D. LM-79-08 (or latest) - IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

E. LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

F. TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

G. NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.

1.4 DEFINITIONS

A. Driver - the power supply used to power LED luminaires, modules, or arrays.

B. L70, $L_{70,}$ or $L_{70\%}$ - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.

C. LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

D. LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

1.5 SYSTEM DESCRIPTION

A. Parking area lighting, RV parking area lighting, and multifunction recreational area lighting of the facility.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire, pole and base.

C. Product Data: Provide dimensions, ratings, performance data, lamp and ballast data, weights and accessory information for each type.

D. Manufacturer's Instructions:
   1. Indicate application conditions and limitations of use stipulated by product testing agency specified under "Regulatory Requirements".
   2. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Light Layout: Provide a computer generated factory point-by-point foot-candle layout of the project for each area involved.

F. Design Data: Include lighting calculations.

G. Post Installation Report: Provide to the Engineer and Owner the results of the measured foot-candle level for each area involved. Use a measuring device pre-approved by Owner.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each luminaire, pole, and underground circuit.

B. Provide record drawings of the final, as installed and measured, point-by-point foot-candle layout for each area involved.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.9 COORDINATION

A. Use bolt templates and pole mounting accessories to install anchor bolts in pole base.

1.10 EXTRA MATERIAL

A. Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the luminaire and are not separate components, then extra LED's are not required.

B. Provide one (1) LED driver of each type. This includes LED drivers.

C. Provide five (5) percent of total fuses provided for each size, but not less than one (1) of each size.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Luminaires manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated luminaires, and meet the intent of the design.

B. Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).

C. Provide luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

2.2 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
1. Minimum Light Output.
2. Zonal Lumen Requirements.
3. Minimum Luminaire Efficacy.
4. Minimum CRI.
5. L70 Lumen Maintenance.
6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

B. Additional requirements:
1. Color Temperature of 3000K-4100K as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
2. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
3. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
4. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
5. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
6. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
7. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
8. Driver shall have a rated life of 50,000 hours, minimum.
9. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
10. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
11. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.

12. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
13. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
14. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
15. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
16. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
17. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
18. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
19. All luminaires shall be provided with knockouts for conduit connections.
20. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
21. Provide all of the following data on submittals:
    a. Delivered lumens.
    b. Input watts.
    c. Efficacy.
    d. Color rendering index.

C. Emergency LED Luminaire Compatibility with Inverters:
1. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.

D. Dimming:
1. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
2. LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or “popcorn effect”. “Popcorn effect” is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

2.3 FUSES

A. Furnish and install a fuse holder and fuse in each ungrounded leg of the electrical circuit supplying the outdoor luminaire. If the voltage is 208, 240, or 480 volts, then the fuse holder needs to be a 2-pole fuse holder which simultaneously disconnects both ungrounded conductors. Every luminaire (including bollards) shall be separately fused with a water-resistant fuse holder. Size the fuse for the amperage of the luminaire. Tap the circuit conductors with a minimum #10 AWG conductor to serve the luminaire. The fuse and holder shall be accessible through the handhole. Provide sufficient wire to bring fuse holder outside of handhole.

2.4 POLES

A. Furnish products as specified in schedule on Drawings.

B. Handhole: With removable weatherproof cover.

C. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole.

2.5 FOUNDATIONS

A. Provide foundations for poles, bollards, and ground-mounted flood and accent lighting. Construct from reinforced concrete in sizes as shown on drawings and to meet the minimum structural requirements of SPS 362.1807 Shallow Post Foundations, and IBC 1807.3 Embedded Posts and Poles.

B. Place the anchor bolts in pole bases so that the luminaire will be oriented perpendicular to the curb/street/sidewalk/parking lot or as indicated on the plan.

C. Provide a concrete-encased electrode (UFER) grounding system for grounding the foundation, luminaire, and pole:
   1. Provide twenty-five (25) feet of #6 bare stranded copper grounding electrode conductor.
   2. Extend three (3) feet of the grounding electrode conductor out the top of the foundation for connection to the luminaire/pole.
   3. Clamp the grounding electrode conductor to the top of the rebar cage. Use a clamp rated for such use such as an Erico EK16 or similar.
   4. Spiral a minimum of ten (10) feet of the grounding electrode conductor around the outside of the rebar cage.
   5. Loop the remaining conductor around the rebar cage at the bottom of the foundation in direct contact with earth.

D. The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.

E. Pole Base J-Boxes:
   1. For pole bases with multiple conduits to other poles/locations, the contractor may provide a non-metallic j-box with a curved cover mounted in the side of the exposed part of the base to accommodate the multiple conduits. Boxes shall be NEMA 3R Carlon Nonmetallic Curved Lid J-Boxes or equal. Mount j-box centered at 20” above grade. Use only in poles 18” in diameter and larger. Locate boxes 90-degrees or 180-degrees from traffic. Install boxes per manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers' instructions.

B. Minimum underground conduit size is 1 inch.

C. Underground and exterior wire shall be type XHHW-2 or USE-2.

D. Project anchor bolts 2 inches (50 mm) minimum above base.

E. Install all anchor bolts and handhole fasteners with anti-seize compound.

F. Install poles plumb. Provide shims or double nuts to adjust plumb.

G. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

H. Bond each luminaire, each metal accessory, the ground rod and the pole to the branch circuit equipment ground conductor with a separate ground wire sized per NEC or as shown on the drawings.

I. Dimmed luminaire circuits shall have separate neutrals.

J. Dimmed luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire so that the luminaires don't "glow" at the lowest dimmed setting. This shall be accomplished using a switch, relay, or some other means acceptable to Engineer.

3.2 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.3 ADJUSTING

A. Aim and adjust luminaires as indicated on Drawings or as directed by the Engineer.

B. All new lamps shall be operational at the Substantial Completion of the project.

3.4 CLEANING

A. Clean photometric control surfaces.

B. Clean finishes and touch up damage.

3.5 CONSTRUCTION VERIFICATION

A. Contractor is responsible for utilizing the construction verification checklists suppliedin accordance with the procedures defined for construction verification checklists.

3.6 OWNER TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified under Division 1.

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SCOPE

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new Fire Alarm System as shown on the drawings and as herein specified. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Requirements.
      c. Reference Standards.
      d. Submittals.
      e. Quality Assurance.
      f. Warranty.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Fire Alarm System.
      c. Fire Safety Systems Interfaces.
      d. Components.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Inspection and Testing for Completion.
      c. Owner Personnel Instruction.
      d. Closeout.
      e. Maintenance.

1.2 RELATED REQUIREMENTS

A. Section 08 33 13 – Coiling Counter Doors: Coiling fire doors to be released by fire alarm system.

B. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

C. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.3 REFERENCE STANDARDS

A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).

B. NFPA 70 - National Electrical Code; 2014.

C. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.

D. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2009.

E. NFPA 601 - Standard for Security Services in Fire Loss Prevention; 2005.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with the contract documents.
   4. Proposed maintenance contract.

C. Drawings must be prepared using most recent version of AutoCAD.
   1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

D. Evidence of designer qualifications.

E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Detailed drawing of graphic annunciator(s).
   11. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   12. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
   13. Certification by Contractor that the system design complies with the contract documents.
   14. Do not show existing components to be removed.

F. Submit all required documents to the appropriate agencies for plan approval/permitting along with fees.

G. Evidence of installer qualifications.

H. Evidence of instructor qualifications; training lesson plan outline.

I. Evidence of maintenance contractor qualifications, if different from installer.

J. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

K. Operating and Maintenance Data: See Section 01 78 23 - Operation and Maintenance Data for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.

2. Complete set of specified design documents, as approved by authority having jurisdiction.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
5. List of recommended spare parts, tools, and instruments for testing.
6. Replacement parts list with current prices, and source of supply.
7. Detailed troubleshooting guide and large scale input/output matrix.
8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

L. Project Record Documents: See Section 01 78 23 - Operation and Maintenance Data for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

M. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.
5. Report on training results.

N. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
3. In addition to the items in quantities indicated in PART 2, furnish the following:
   a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
   b. One copy, on CD-ROM, of all software not resident in read-only-memory.
   c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.5 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
   4. Contract **maintenance office** located **within 100 miles OR within 2hrs drive time of project site.**
   5. Certified in the State in which the Project is located as fire alarm installer.

D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.6 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units - Basis of Design: Firelite Addressable System

B. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
   1. Honeywell Security & Fire Solutions/Gamewell-FCI: www.gamewell-fci.com.
   2. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com.
   3. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
   4. Honeywell Security & Fire Solutions/Silent Knight: www.silentknight.com.
   5. Siemens Building Technologies, Inc: www.sbt.siemens.com.
   6. SimplexGrinnell: www.simplexgrinnell.com.
   7. Provide all control units made by the same manufacturer.

C. Initiating Devices, and Notification Appliances:
   1. Honeywell Security & Fire Solutions/Gamewell-FCI: www.gamewell-fci.com.
   2. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com.
   3. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
   4. Honeywell Security & Fire Solutions/Silent Knight: www.silentknight.com.
   5. Siemens Building Technologies, Inc: www.sbt.siemens.com.
   6. SimplexGrinnell: www.simplexgrinnell.com.
   7. Same manufacturer as control units.
   8. Provide all initiating devices and notification appliances made by the same manufacturer.

D. Substitutions: See Section 01 60 00 - Product Requirements.
1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with contract documents.
2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
1. Provide all components necessary, regardless of whether shown in the contract documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
a. The Americans With Disabilities Act (ADA).
b. The requirements of the State Fire Marshal.
c. The requirements of the local authority having jurisdiction.
d. Applicable local codes.
e. The contract documents (drawings and specifications).
f. NFPA 101.
g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
5. Program notification zones and voice messages as directed by Owner.
6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
7. Master Control Unit (Panel): New,
8. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.
9. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By oFF-premises supervising station.
2. On-Premises Supervising Station: None.
3. Remote Supervising Station: UL-listed central station under contract to facility.
4. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 2.
4. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.

2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.3 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
3. Duct smoke detectors.

C. HVAC:
1. Duct Smoke Detectors: shut down air handlers indicated.

D. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from.
3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.

2.4 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Remote Annunciators: 1Circuit Conductors: Copper or optical fibe; provide 200 feet extra; color code and label.

E. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

F. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type.

2. Provide a different standard lock and key for each key operated alarm initiating device; provide 25 keys of each type.

G. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

H. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
2. Locate as directed by Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

F. Provide all tools, software, and supplies required to accomplish inspection and testing.

G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
1. Record all system operations and malfunctions.
2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.3 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

C. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to Owner.
   5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   6. Occupancy permit has been granted.
   7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.5 MAINTENANCE

A. See Section 01 77 00 - Closeout Procedures, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.

D. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.

2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

E. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

F. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

G. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

H. Comply with Owner's requirements for access to facility and security.

END OF SECTION

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SECTION 31 10 00 - SITE CLEARING

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. Protecting existing trees to remain.
2. Removing existing trees.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities**,** and temporary erosion and sedimentation control procedures.
2. Division 1 Section "Execution Requirements" for verifying utility locations and for recording field measurements.
3. Division 1 Section "Selective Demolition" for partial demolition of buildings or structures undergoing alterations.
4. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.
5. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site that are affected by site operations.
6. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
7. Division 2 Section "Lawns and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within tree protection zones.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 10 00

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SECTION 31 20 00 – EARTH MOVING

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. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and /or exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks an/or pavements.
5. Subbase and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling for utility trenches.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 1 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
2. Division 1 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
3. Division 1 Section "Construction Progress Documentation" for recording pre-excavation and earthwork progress.
4. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
5. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
6. Division 2 Section "Lawns and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
7. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.

1.3 UNIT PRICES

A. Unit prices for earthwork are included in Division 1 Section "Unit Prices."

B. Quantity allowances for earthwork are included in Division 1 Section "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches (600 mm) outside of concrete forms other than at footings.
2. 12 inches (300 mm) outside of concrete forms at footings.
3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed **1 cu. yd. (0.76 cu. m)** for bulk excavation or **3/4 cu. yd. (0.57 cu. m)** for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force

of not less than 28,090 lbf (125 kN) and stick-crowd force of not less than 18,650 lbf (83 kN); measured according to SAE J-1179.

2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp (157-kW) flywheel power and developing a minimum of 48,510-lbf (216-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by an independent geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Geotextile.
3. Controlled low-strength material, including design mixture.
4. Geofoam.

B. Samples: 12-by-12-inch (300-by-300-mm) Sample of geotextile fabrics.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site soil material proposed for fill and backfill.

D. Blasting Plan: For record purposes, approved by authorities having jurisdiction.

E. Seismic Survey Report: For record purposes; from seismic survey agency.

F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: **ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM**, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups **GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487**, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. M) at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi (550 kPa) when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495.

2.4 GEOFOAM (NOT APPLICABLE)

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft. (26 kg/cu. M).

B. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m).

1. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.

C. Geofoam Connectors: Geofoam manufacturer's multibarbed galvanized steel sheet connectors.

2.5 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with

metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.

2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches (600 mm) outside of concrete forms other than at footings.
    b. 12 inches (300 mm) outside of concrete forms at footings.
    c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches (150 mm) beneath bottom of concrete slabs on grade.
    f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches (600 mm) outside of concrete forms other than at footings.
    b. 12 inches (300 mm) outside of concrete forms at footings.
    c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches (150 mm) beneath bottom of concrete slabs on grade.
    f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction**,** repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."

D. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 GEOFOAM FILL

A. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

1. Place leveling course on subgrades free of mud, frost, snow, or ice.

B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.

C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.

D. Cover geofoam with separation geotextile before placing overlying soil materials.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm)
2. Walks: Plus or minus 1/2 inch (13 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.18 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.19 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing

subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet (30 m) or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 20 00

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SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil treatment.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood preservative treatment by pressure process.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for custom-fabricated, metal termite shields.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
   2. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of termite control product.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

D. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

1.5 FIELD CONDITIONS

A. Soil Treatment:
   1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
   2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain termite control products from single source from single manufacturer.

2.2 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Corporation; Termidor.
      b. Bayer Environmental Science;Premise Pre-Construction or Premise Pro.
      c. Ensystex, Inc; Maxxthor SC or Prothor SC2.
      d. Syngenta; Demon Max.
   2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
   1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
   3. Crawlspaces: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
   4. Masonry: Treat voids.
   5. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.4 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION

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SECTION 32 14 00 - UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete pavers set in aggregate and mortar setting beds.
2. Aluminum edge restraints.
3. Cast-in-place concrete edge restraints.

B. Related Sections:
1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete curbs serving as edge restraints for unit pavers.

1.2 ACTION SUBMITTALS

A. Product Data: For materials other than water and aggregates.

B. Product Data: For the following:
1. Pavers.
2. Mortar and grout materials (for edge pavers).
3. Edge restraints.

C. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

D. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.

E. Samples for Initial Selection: For the following:
1. Each type of unit paver indicated.
2. Joint materials involving color selection.
3. Exposed edge restraints involving color selection.

F. Samples for Verification:
1. Full-size units of each type of unit paver indicated.
2. Joint materials.
3. Exposed edge restraints.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided. Materials shall be covered to prevent removal by wind.

1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:
   1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
      a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

1.6 MAINTENANCE MATERIALS

A. Provide 100 square feet additional paver material for use by Owner for maintenance and repair.

B. Store extra paver materials in Owner-designated location.

PART 2 - PRODUCTS

2.1 CONCRETE PAVERS

A. Concrete Pavers: Solid interlocking paving units complying with ASTM C 936 and resistant to freezing and thawing when tested according to ASTM C 67, made from normal-weight aggregates.
   1. Basis of Design: Subject to compliance with requirements, provide Belgard Moduline or comparable products by one of the following:
      a. Hanover Pavers.
   2. Thickness: 3-1/8 inches.
   3. Face Size and Shape: rectangle, size as indicated on Architectural Drawings.
   4. Color: As selected by Architect from manufacturer's full range.
   5. Finish: As selected by Architect from manufacturer's full range.
   6. Pattern: Running bond as indicated on drawings.

2.2 CURBS AND EDGE RESTRAINTS

A. Aluminum Edge Restraints: Manufacturer's standard L-shaped, 3/16-inch-thick by 2-1/4-inch-high extruded-aluminum edging with loops pressed from face to receive stakes at 12 inches o.c., and aluminum stakes 12 inches long for each loop.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brickstop Corporation.
      b. Curv-Rite, Inc.

c. Permaloc Corporation.
d. Sure-loc Edging Corporation.

B. Job-Built Concrete Edge Restraints: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi.

2.3 ACCESSORIES

A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.

2.4 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 8.

B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.

C. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.
1. Provide sand of color needed to produce required joint color.

D. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2, AASHTO M 288.
2. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

E. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2, AASHTO M 288.
2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

F. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

2.5 MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144.

D. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.

E. Thinset Mortar: Latex-modified portland cement mortar complying with ANSI A118.4.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Boiardi Products; a QEP company.

b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. Mer-Krete System, ParexLahabra, Inc.
i. ProSpec.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC, Specialty Construction Brands, Inc.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

F. Water: Potable.

G. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch in diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M except for minimum wire size.

2.6 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7, sanded.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Boiardi Products; a QEP company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. ProSpec.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC, Specialty Construction Brands, Inc.
2. Polymer Type: Ethylene-vinyl acetate or acrylic additive in dry, redispersible form; prepackaged with other dry ingredients.

B. Grout Colors: As selected by Architect from manufacturer's full range.

C. Water: Potable.

2.7 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Mortar-Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.

C. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

D. Thinset Mortar Bond Coat: Proportion and mix thinset mortar ingredients according to manufacturer's written instructions.

E. Packaged Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive basecourse for unit pavers.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
   1. For concrete pavers, a double-bladed block splitter may be used.
   2. Upon completion of cutting, the area must be swept clean of all debris to facilitate inspection and to ensure the concrete pavers are not damaged during compaction.

D. Joint Pattern: Running bond as indicated.

E. Tolerances: Do not exceed 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

F. Expansion and Control Joints: Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.

G. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
   1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
   2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
   3. Install job-built concrete edge restraints to comply with requirements in Section 03 30 00 "Cast-in-Place Concrete."
   4. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4 AGGREGATE SETTING-BED APPLICATIONS

A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.

B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.

D. Place aggregate subbase and base, compact by tamping with plate vibrator, and screed to depth indicated.

E. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.

F. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

G. Treat leveling course with herbicide to inhibit growth of grass and weeds.

H. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.
   1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

I. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
   1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
   2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
   3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
   4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

J. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

K. Do not allow traffic on installed pavers until sand has been vibrated into joints.

L. Repeat joint-filling process 30 days later.

3.5 MORTAR SETTING-BED APPLICATIONS (AT EDGE PAVERS)

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.

C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Place reinforcing wire over concrete subbase, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of mortar bed. Hold edges back from vertical surfaces approximately 1/2 inch.

E. Place mortar bed with reinforcing wire fully embedded in middle of mortar bed. Spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

F. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

G. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch-thick bond coat to mortar bed or to back of each paver with a flat trowel.

H. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

I. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16 inch.

J. Grouted Joints: Grout paver joints complying with ANSI A108.10.

K. Grout joints as soon as possible after initial set of setting bed.
   1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
   2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
   3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

L. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.6 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

3.7 AS-BUILT CONSTRUCTION TOLERANCES

A. Final inspection shall be conducted to verify conformance to the drawings after removal of excess joint sand.

B. The final surface elevations shall not deviate more than 3/8 inch (10 mm) under a 10-foot long (3 m) straightedge.

C. Lippage: No greater than 1/8 inch (3 mm) difference in height between adjacent pavers.

END OF SECTION

SECTION 32 15 43 – EQUESTRIAN ARENA AGGREGATE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Sub-grade preparation for indoor arenas.
   2. Arena cushion soil mix for indoor a arenas.

B. Related Sections include the following:
   1. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil.
   2. Division 31 Section “Earthwork” for site grading and preparation.

1.2 SUBMITTALS

A. Product Data: Provide sieve analysis on arena sub-base materials to be provided.

B. Product Data: Provide particle size distribution analysis on arena cushion mixture.

C. Samples: Provide a five-gallon sample of arena topping soil mix for review and approval by Owner and Architect.

1.3 MOCK-UP

A. Arena footing material selection and mock-up must be done in a timeframe that will guarantee that the installed material is the same consistency of the mock-up and from the same earth layer from the source quarry.

B. Provide a 20’ x 20’ mock-up section illustrating the required layers and materials of the arena footing design for viewing and approval by Owner.

C. Locate where directed outside the arena area.

D. Approved mock-up to remain in place until arena footing work is complete and approved by Owner. After approval of the Work, remove mock-up and return area to original condition prior to mock-up.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified footing consultant whose work has resulted in successful equestrian arena surfaces.

B. Source Limitations: Obtain arena footing from local or regional quarries.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E-329 to provide on-site supervision of material placement and to conduct soil materials testing, as documented according to ASTM D-3740 and ASTM E-548.

PART 2 - PRODUCTS

2.1 ARENA MATERIALS

A. Compacted Sub-grade: Select on-site material approved by Architect.

B. Arena Cushion: 60 percent clean, well graded washed angulated sand, USC Group Symbol SW from ASTM D-2487; 40 percent Loam, USC Group Symbol CL/ML, with a maximum PI of 7.
   1. 5 percent fines passing through No. 200 sieve for sand material.
   2. Do not use beach or river sand.

PART 3 - EXECUTION

3.1 GROUND SURFACE PREPARATION

A. INDOOR ARENA
   1. Remove all debris, nails, glass, rocks, trash and objects, which could be detrimental to horses.
   2. Prepare sub-grade to levels as indicated or to a depth to allow specified thickness of aggregate base course and arena cushion. Finish cushion shall be slightly lower than surrounding finish floor.
   3. Notify Architect and Geotechnical Engineer when excavations have reached required sub-grade.
   4. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting and replace with compacted backfill or fill as directed by Geotechnical Engineer.
   5. Compact entire existing sub-grade to 98% standard proctor density (ASTM D 698).

3.2 PLACEMENT

A. ARENA CUSHION
   1. Place arena cushion material in multiple lifts as follows:
      a. 12” footing to be installed in 4” lifts.

END OF SECTION

SECTION 32 18 16 EQUINE PROTECTIVE SURFACING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Installation of 100% recycled rubber granule, seamless, specialty flooring.

B. Related Sections:
   1. Section 03 30 00 "Cast-in-Place Concrete" for interior concrete floor slabs.
   2. Section 32 50 10 “Hot-Mix Asphalt Paving” for construction of asphalt paving.
   3. Section 32 50 15 "Cement Concrete Pavement" for construction of cement concrete pavement.

1.2 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: According to ASTM F 1292.

B. Accessibility of Surface Systems: According to ASTM F 1951.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each flooring component required.

B. Shop Drawings: For each surface system, include materials, plans, cross sections, drainage, installation and edge termination.
   1. Patterns and colors.

C. Samples for Verification: For each type of protective equine surfacing system indicated,12 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
   1. Extent of surface systems and use zones for equipment.
   2. Critical heights for surfaces and fall heights for equipment.

B. Qualification Data: For qualified installer.

C. Material Certificates: For each type of loose-fill equine surface system, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

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 and mixing with other components.

B. Storage: Store only acceptable project materials on site, in suitable location convenient to progress of work. Comply with all health and fire regulations. Product should be stored in a dry area protected from the weather on a smooth, flat, dry surface with temperatures maintained between 50° F and 90° F, or such ambient temperature conditions as may be specifically recommended by manufacturer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Certified in writing by equine flooring manufacturer as qualified to apply equine flooring systems indicated.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit equine surface system installation to be performed according to manufacturers' written instructions and warranty requirements.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For equine surface system to include in maintenance manuals.

B. Source Limitations: Obtain Protective surface system materials, including primers, and adhesives, form single source, or as recommended by manufacturer of protective surface system materials.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of protective equine surfacing system that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Wear-through of the surface layer under normal and proper usage for the specified period for the specified product and its intended use.
   2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary equine flooring materials from single manufacturer.
   1. Basis-of-Design Manufacturer: Polylast Systems, LLC
      7432 E. Tierra Buena Ln #105
      Scottsdale, AZ 85260
      Phone: 480-998-3033.

2.2 UNITARY SYNTHETIC SEAMLESS SURFACE

A. Protective Surface System. Poured-in-place, with proprietary top coat. Provide manufacturer’s standard thickness as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F1951.
   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. Polylast Equine Flooring SurfaceGuard Systems with Microban Antimicrobial Technology, LLC, Equine Solutions.
         1) Super Duty Flooring

2. Cushion Course: Manufacturer's standard blend of recycled SBR and EPDM rubber, particles forming an integral wearing course and cushion course, site mixed and applied.
3. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content.
4. Wearing Course: Manufacturer's proprietary top coat product.
5. Overall Thickness: Not less than 3/4" or as recommended by manufacturer.
6. Weight 3.3 lbs./sq. ft. (for 3/4" thickness).
7. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location indicated.
8. Color(s) of Top Coat: As selected by Architect from manufacturer's full range.
9. Technical Data:
    a. ASTM D2240, Shore A - Hardness, 5 tests, 51.0 – 59.0: Average = 55.6 (±3.0).
    b. ASTM D2047, Static Coefficient of Friction: Average (SCOF) = 0.75.
    c. ASTM F925, Resistance to Chemicals, 60 Minutes and 24 hours: Passed with no change in surface dulling, attack, or color (White Vinegar, Rubbing Alcohol (70%), White Mineral Oil, Sodium Hydroxide (5%), Hydrochloric Acid (5%), Sulfuric Acid (5%), Household Ammonia (5%), Household Bleach (5%), Disinfectant - phenol type (5%), Unleaded Gasoline).
    d. ASTM D3389: Abrasion Resistance, Passed with < 1.00 gram weight loss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, and other conditions affecting performance of the Work.
    1. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, free from surface defects, and free of dust dirt loose, particles, grease, oil and other contaminants incompatible with equine surface system or that may interfere with adhesive bond.
    2. Concrete Substrates: Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing system manufacturer.

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

3.2 PREPARATION

A. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Concrete and Asphalt Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
    1. Repair unsatisfactory surfaces and fill holes and depressions.
    2. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing system.

3.3 INSTALLATION, GENERAL

A. General: Comply with protective surfacing system manufacturer's written installation instructions. Install protective surfacing system over area and in thickness indicated in the drawings.

B. All surfaces will be inspected prior to installation and must be clean, smooth, dry, flat, and structurally sound. The installation surface must be free of moisture, sealers, paint, adhesives, solvents, mold, mildew, and any other coatings or films.

3.4 INSTALLATION OF SEAMLESS PROTECTIVE SURFACING SYSTEMS

A. Seamless Surface: Mix and apply components of protective surface system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface and impact-attenuating system of total thickness indicated.
   1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
   2. Poured Cushion Course: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
   3. Intercoat Primer: Over cured cushion course, apply primer at manufacturer's standard spreading rate.
   4. Wearing Course: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.

3.5 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.7 PROTECTION

A. Prevent human and canine traffic over specialty flooring system for not less than 24 hours and prevent equine and livestock traffic over system for not less than 48 hours after installation.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Chain-link fences.
   2. Swing gates.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review coordination of interlocked equipment specified in this Section and elsewhere.
   2. Review required testing, inspecting, and certifying procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Fence and gate posts, rails, and fittings.
      b. Chain-link fabric, reinforcements, and attachments.
      c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
   1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer and testing agency.

B. Product Certificates: For each type of chain-link fence, and gate.

C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design chain-link fence and gate frameworks. Engineer must be licensed in the State of Oklahoma.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
   1. Design Wind Load: As indicated on Structural Drawings.
      a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 10 feet for Material Group IC, electric-resistance-welded round steel pipe.

C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
   1. Fabric Height: As indicated on Drawings.
   2. Steel Wire for Fabric: Wire diameter of 0.148 inch.
      a. Mesh Size: 2 inches.
      b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
      c. Polymer-Coated Fabric: ASTM F 668, Class 2a or Class 2b over zinc-coated steel wire.
         1) Color: Black, according to ASTM F 934.
   3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
   1. Fence Height: As indicated on Drawings.
   2. Horizontal Framework Members: Intermediate, top and bottom rails according to ASTM F 1043.
      a. Top Rail: 1.66 inches in diameter.

3. Metallic Coating for Steel Framework:
   a. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
   b. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
   c. Coatings: Any coating above.
4. Polymer coating over metallic coating.
   a. Color: Match chain-link fabric, according to ASTM F 934.

2.4 SWING GATES

A. General: ASTM F 900 for gate posts and double swing gate types.
   1. Gate Leaf Width: As indicated.
   2. Framework Member Sizes and Strength: Based on gate fabric height as indicated.

B. Pipe and Tubing:
   1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
   2. Gate Posts: Round tubular steel.
   3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:
   1. Hinges: 180-degree inward swing.
   2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.5 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each post.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
      a. Hot-Dip Galvanized Steel: 0.106-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:
1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
a. Polymer coating over metallic coating.

2.6 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.7 GROUNDING MATERIALS

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
1. Install fencing on established boundary lines inside property line.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
a. Concealed Concrete: Place top of concrete 4 inches below grade to allow covering with surface material.

C. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

D. Line Posts: Space line posts uniformly at 96 inches o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Secure to posts with fittings.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade and surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts and rails. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
   1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:
   1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
   2. Install ground rods and connections at maximum intervals of 1500 feet.
   3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
   4. Ground fence on each side of gates and other fence openings.
      a. Bond metal gates to gate posts.
      b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
   1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
   2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

F. Connections:
   1. Make connections with clean, bare metal at points of contact.
   2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   4. Make above-grade ground connections with mechanical fasteners.
   5. Make below-grade ground connections with exothermic welds.
   6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Decorative metallic-coated-steel tubular picket fences.
2. Swing gates.
3. Horizontal-slide gates.
4. Gate operators, including controls.

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls and post concrete fill.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
1. Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.
1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 12 inches square for bar grating and sheet or plate materials.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Product Test Reports: For decorative metallic-coated-steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Include 10-foot length of fence complying with requirements.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES

A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F 2408 for light industrial (commercial) application (class) unless otherwise indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Fence Products, Montage II, Welded and Rackable (ATF – All Terrain Flexibility) Ornamental Steel Genesis design, extended picket bottom rail treatment, 4-Rail style; or comparable product by one of the following:
      a. BetaFence USA LLC.
      b. Fortress Iron.
      c. Hill & Smith Inc.
      d. Iron Eagle Industries, Inc.
      e. Iron World Manufacturing, LLC.
      f. Master Halco.
      g. Merchants Metals.
      h. Virginia Railing and Gates, LLC.
      i. Xcel Fence.

B. Posts:
   1. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
   2. Posts at Swing Gate Openings: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
   3. Posts at Horizontal-Slide Gate Openings Wider Than 12 Feet: Square steel tubing 4 by 4 inches with 3/16-inch wall thickness, hot-dip galvanized.
   4. Guide Posts for Class 1 Horizontal-Slide Gates: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.

C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.

D. Rails: Square tubes.
   1. Size: 1-3/4 by 1-3/4 inches.
   2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.

E. Pickets: Square tubes.
   1. Terminate tops of pickets at top rail for flush top appearance.
   2. Picket Spacing: 4 inches clear, maximum.

F. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers.

G. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.

H. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior.

I. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

J. Finish: Organic coating complying with requirements in ASTM F 2408.
1. Color: Prefinished black.

2.3 SWING GATES

A. Manufacturer:
1. Basis-of-Design: Subject to compliance with requirements, provide Ameristar Fence Products, Montage II Steel Gate, extended picket bottom rail treatment, 4-Rail style; or comparable product by one of the following:
   a. BetaFence USA LLC.
   b. Fortress Iron.
   c. Hill & Smith Inc.
   d. Iron Eagle Industries, Inc.
   e. Iron World Manufacturing, LLC.
   f. Master Halco.
   g. Merchants Metals.
   h. Virginia Railing and Gates, LLC.
   i. Xcel Fence.

B. Gate Configuration: As indicated.

C. Gate Frame Height: As indicated.

D. Gate Opening Width: As indicated.

E. Automated vehicular gates shall comply with ASTM F 2200, Class II.

F. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.

G. Frame Corner Construction: Welded.

H. Additional Rails: Provide as indicated, complying with requirements for fence rails.

I. Infill: Comply with requirements for adjacent fence.

J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

K. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

L. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
1. Function: 39 - Full surface, triple weight, antifriction bearing.
   a. Gate hardware to accommodate 180 degree swing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.

M. Rim Locks: BHMA A156.5, Grade 1, suitable for exterior use.
1. Function: 626 - Interlocking deadbolt operated by key from either side.
2. Material: Cast, forged, or extruded brass or bronze.
3. Mounting Plate: Configuration necessary for mounting locks. Fabricate from 1/8-inch-thick, steel plate; galvanized.

N. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail-safe, and suitable for exterior use.
   1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch-thick, steel plate; galvanized.
   2. Mounting: Mortise into post.

O. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4-inch- diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

P. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

Q. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

R. Metallic-Coated-Steel Finish: High-performance coating.
   1. Color: Prefinished black.

2.4 HORIZONTAL-SLIDE GATES

A. Manufacturer:
   1. Basis-of-Design: Subject to compliance with requirements, provide Ameristar Fence Products, Passport II Steel Roll Gate – Bi-Parting; or comparable product by one of the following:
      a. BetaFence USA LLC.
      b. Fortress Iron.
      c. Hill & Smith Inc.
      d. Iron Eagle Industries, Inc.
      e. Iron World Manufacturing, LLC.
      f. Master Halco.
      g. Merchants Metals.
      h. Virginia Railing and Gates, LLC.
      i. Xcel Fence.

B. Gate Configuration: As indicated.
   1. Type: Cantilever slide, with external roller assemblies.

C. Gate Frame Height: As indicated.

D. Gate Opening Width: As indicated.

E. Automated vehicular gates shall comply with ASTM F 2200, Class II.

F. Steel Frames and Bracing: Fabricate members from square tubing. Hot-dip galvanize frames after fabrication.
   1. Frame Members: Steel tubing 2-1/2 by 2-1/2 inches with 1/8-inch wall thickness.
   2. Bracing Members: Steel tubing 1-1/2 by 1-1/2 inches with 1/8-inch wall thickness.

G. Frame Corner Construction:
   1. Welded frame and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.

H. Additional Rails: Provide as indicated, complying with requirements for rails.

I. Infill: As indicated on Drawings.

J. Picket Size, Configuration, and Spacing: As indicated.

K. Hardware: Latches permitting operation from both sides of gate, locking devices, roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

N. Metallic-Coated-Steel Finish: High-performance coating.
1. Color: Prefinished black.

2.5 GATE OPERATORS

A. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
2. Provide operator with UL -approved components.
3. Provide electronic components with built-in troubleshooting diagnostic feature.
4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

B. Comply with NFPA 70.

C. UL Standard: Manufacturer and label gate operators to comply with UL 325.

D. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

E. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1.

F. Gate Operators: Gate mounted and as follows:
1. Hydraulic Swing and Slide Gate Operators:
a. Duty: Heavy duty, commercial/industrial.
b. Gate Speed: Minimum 60 feet per minute.
c. Maximum Gate Weight: As indicated.
d. Frequency of Use: Continuous duty.
e. Operating Type: Wheel-and-rail drive with manual release.
f. Hydraulic Fluid: Of viscosity required for gate operation at ambient temperature range for Project.
g. Locking: Hydraulic in both directions.
h. Heater: Manufacturer's standard track and roller heater with thermostatic control.

G. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and loop detector designed to open and close gate. System includes electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing by detection system manufacturer for function indicated, at location shown on Drawings.

H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
   1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
   2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
   3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.
      a. Along entire gate leaf leading edge.
      b. Along entire gate leaf trailing edge.
      c. Along entire length of gate posts.
   4. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

J. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
   1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

K. Operating Features:
   1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
   2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
   3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
   4. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch.
   5. Open Override Circuit: Designed to override closing commands.
   6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
   7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
   8. Clock Timer: 24-hour programmable for regular events.

L. Accessories:
   1. Warning Module: Audio, Visual, strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
   2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
      a. Fail-Safe: Gate opens and remains open until power is restored.
      b. Fail-Secure: Gate cycles on battery power, then fail-safe when battery is discharged.
   3. External electric-powered solenoid or magnetic lock with delay timer allowing time for lock to release before gate operates.
   4. Fire strobe sensor.
   5. Intercom System..
   6. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.
   7. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.6 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Bar Grating: NAAMM MBG 531.
   1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
   2. Wire Rods: ASTM A 510.

E. Uncoated Steel Sheet: Cold-rolled steel sheet, ASTM A 1008/A 1008M, Structural Steel, Grade 50.

F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90 coating.

G. Castings: Either gray or malleable iron unless otherwise indicated.
   1. Gray Iron: ASTM A 48/A 48M, Class 30.
   2. Malleable Iron: ASTM A 47/A 47M.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
   1. Material above Finished Grade: Copper.
   2. Material on or below Finished Grade: Copper.
   3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.
   1. Connectors for Below-Grade Use: Exothermic-welded type.
   2. Grounding Rods: Copper-clad steel.
      a. Size: 5/8 by 96 inches.

2.9 METALLIC-COATED-STEEL FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

B. Powder Coating: Immediately after cleaning and pretreating, apply two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.
   1. Color and Gloss: Black.
   2. Comply with surface finish testing requirements in ASTM F 2408.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures.
   1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.3 DECORATIVE FENCE POST INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
      b. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
   3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
   4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
      a. Extend posts at least 5 inches into sleeve.
      b. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
   5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.
      a. Extend posts at least 5 inches into concrete.
      b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
   6. Mechanically Driven Posts: Drive into soil to depth of 30 inches. Protect post top to prevent distortion.
   7. Space posts uniformly and equally at maximum 8 feet o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 GROUNDING AND BONDING

A. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

B. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

C. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

D. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
   1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
   2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
   3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
   1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

3.9 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION

SECTION 32 40 10 - WATER DISTRIBUTION

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 water-distribution piping and specialties outside the building for the following:

1. Water services.
2. Fire-service mains.
3. Combined water service and fire-service mains.
4. Aboveground water piping for applications other than water-service piping.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

B. Fire-Service Main: Exterior fire-suppression-water piping.

C. Fire-Suppression-Water Piping: Interior fire-suppression-water piping.

D. Water-Distribution Piping: Interior domestic-water piping.

E. Water Service: Exterior domestic-water piping.

F. The following are industry abbreviations for plastic materials:

1. PA: Polyamide (nylon) plastic.
2. PE: Polyethylene plastic.
3. PEX: Crosslinked polyethylene plastic.
4. PP: Polypropylene plastic.
5. PVC: Polyvinyl chloride plastic.
6. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
7. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Piping specialties.
2. Valves and accessories.
3. Water meters and accessories.
4. Backflow preventers and assemblies.
5. Protective enclosures.
6. Fire hydrants.
7. Flushing hydrants.
8. Fire department connections.
9. Alarm devices.
10. Post hydrants.
11. Drinking fountains.

B. Shop Drawings: For the following:

1. Precast concrete vaults, including frames and covers, ladders, and drains.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: For piping and specialties including relation to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field Quality-Control Test Reports: From Contractor.

E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Water meters.
2. Valves.
3. Backflow preventers.
4. Protective enclosures.
5. Fire hydrants.
6. Flushing hydrants.
7. Post hydrants.
8. Drinking fountains.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

F. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

G. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

H. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATION

A. All materials for water line construction shall conform to the standards and specifications of the City of El Reno, Oklahoma. These standards and specifications are incorporated herein by reference.

Where conflicts exist between the two sets of standards and specifications, the more stringent choice will be applied.

2.2 PIPING MATERIALS

A. All water lines shall be constructed using AWWA C900 PVP pipe.

B. All water line fittings and valves shall be constructed using Class 150 Ductile Iron fittings. Ductile Iron fittings shall by polywrapped for corrosion protection. Fittings and valves shall be restrained by Megalug Mechanical Joint Restraints prior to thrust blocking.

C. Thrust blocks shall be constructed using 300 psi, non-reinforced concrete.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 INSTALLATION SPECIFICATION

A. All materials for water line construction shall conform to the standards and specifications of the City of El Reno, Oklahoma. These standards and specifications are incorporated herein by reference.

Where conflicts exist between the two sets of standards and specifications, the more stringent choice will be applied.

3.3 TESTING & DISINFECTION

A. Water lines shall be pressure tested for leaks in accordance with City of El Reno and Oklahoma Department of Environmental Quality specifications.

B. Water lines shall be flushed and disinfected prior to being placed in service. A 2” blow-off valve shall be installed at each end of the water line to clear the line before and after disinfection.

END OF SECTION 32 40 10

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SECTION 32 40 20 - SANITARY SEWERAGE

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 gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:

1. Special fittings for expansion and deflection.
2. Backwater valves.
3. Cleanouts.
4. Corrosion-protection piping encasement.
5. Cast-in-place concrete manholes.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. FRP: Fiberglass-reinforced plastic.

D. LLDPE: Linear low-density, polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.

I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.

J. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: **10-foot head of water (30 kPa)**.

B. Force-Main, Pressure-Piping Pressure Rating: At least equal to system operating pressure but not less than **150 psig (1035 kPa)**.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.
2. Backwater valves.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATIONS

A. All materials for sanitary sewer line construction shall conform to the standards and specifications of the City of El Reno, Oklahoma. These standards and specifications are incorporated herein by reference.

2.2 PIPING MATERIALS

A. All sanitary sewer lines and cleanouts shall be constructed using PVC SDR 35 pipe.

B. All sanitary sewer manholes shall be poured concrete base and sealed joints.

C. All sanitary sewer manhole frames and covers shall be cast iron.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 INSTALLATION SPECIFICATION

A. All materials for sanitary sewer line construction shall conform to the standards and specifications of the City of El Reno, Oklahoma. These standards and specifications are incorporated herein by reference.

3.3 TESTING

A. Sanitary sewer lines shall be pressure tested for leaks in accordance with City of El Reno and Oklahoma Department of Environmental Quality specifications.

END OF SECTION 32 40 20

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SECTION 32 40 30 - STORM DRAINAGE

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 gravity-flow, non-pressure storm drainage outside the building, with the following components:

1. Piping.
2. Drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. FRP: Fiberglass-reinforced plastic.

D. LLDPE: Linear low-density, polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.

I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.

J. TPE: Thermoplastic elastomer.

K. HDPE: High Density Polyethylene

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: **10-foot head of water (30 kPa).** Pipe joints shall be at least silt-tight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.
2. Backwater valves.
3. Drains.
4. Channel drainage systems.
5. Storage and leaching chambers.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.
2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATION

A. All materials for public storm drainage construction shall conform to the standards and specifications of the City of El Reno, Oklahoma. These standards and specifications are incorporated herein by reference. All materials for nonpublic storm drainage construction shall conform to this specification and the notes, details and drawings as shown in the plans.

2.2 MATERIALS

A. Roof drain collection system piping, fittings and end sections shall be constructed using HDPE pipe, ADS N12IB or approved equal.

B. Roof drain collection system Type 1 inlets shall be constructed using Nyoplast 15-inch ADS PVC Drain Basins with heavy duty)H-25), hinged ductile iron grates or approved equal.

C. Storm sewer pipe and end sections shall be constructed using HDPE Pipe, ADSN12IB or approved equal.

D. Inlet 2, SMD, Type 1 shall be constructed in accordance with Oklahoma Department of Transportation Standard Median Drain with Type 1 Grate.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 INSTALLATION SPECIFICATION

A. All materials for storm drainage construction shall conform to the standards and specifications of the City of El Reno, Oklahoma. These standards and specifications are incorporated herein by reference.

END OF SECTION 32 40 30

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SECTION 32 50 10 - HOT-MIX ASPHALT PAVING

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. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving overlay.
4. Asphalt surface treatments.
5. Pavement-marking paint.
6. Cold milling of existing hot-mix asphalt pavement.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.
2. Division 2 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.
3. Division 2 Section "Unit Pavers" for bituminous setting bed for pavers.

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.

1. Standard Specification: Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction.
2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Job-Mix Designs: For each job mix proposed for the Work.

D. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

E. Samples: For each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.

F. Qualification Data: For manufacturer.

G. Material Test Reports: For each paving material.

H. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction for asphalt paving work.

D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
2. Review condition of subgrade and preparatory work.
3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATION

A. All materials for hot-mix asphalt construction shall conform to the standards and specifications of the Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction. These standards and specifications are incorporated herein by reference.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION SPECIFICATION

A. All installation for hot-mix asphalt paving shall conform to the Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction. These standards and specifications are incorporated herein by reference.

END OF SECTION 32 50 10

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SECTION 32 50 15 - CEMENT CONCRETE PAVEMENT

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 exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.
5. Unit paver base.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
2. Division 2 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.
3. Division 2 Section "Stamped Cement Concrete Pavement" for surface-imprinted, stamped finished concrete pavement.
4. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Samples: **10-lb (4.5-kg)** sample of exposed aggregate.

D. Qualification Data: For testing agency.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

G. Field quality-control test reports.

H. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who 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."

B. 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.

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.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.

6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-installation 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 pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATION

A. All installation for P.C. concrete paving and reinforcing steel shall conform to the Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction. These standards and specifications are incorporated herein by reference.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of **1/2 inch (13 mm)** require correction according to requirements in Division 2 Section "Earthwork."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. All installation for P.C. concrete paving and reinforcing steel shall conform to the Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction. These standards and specifications are incorporated herein by reference.

END OF SECTION 32 50 15

SECTION 32 50 20 - PAVEMENT JOINT SEALANTS

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. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 2 Section "Hot-Mix Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.
3. Division 7 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Pre-construction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATION

A. All installation for pavement joint sealers shall conform to the Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction. These standards and specifications are incorporated herein by reference.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. All installation for pavement joint sealers shall conform to the Oklahoma Department of Transportation 2009 Standard Specifications for Highway Construction. These standards and specifications are incorporated herein by reference.

END OF SECTION 32 50 20

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SECTION – 32 92 00 TURF AND GRASSES

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. Seeding.
2. Hydroseeding (Bonded Fiber Matrix)
3. Sodding.

B. Related Sections:
1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Division 32 Section "Planting Irrigation" for turf irrigation.
4. Division Section "

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

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

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

2. Samples and Product Information for solid sod: Representative samples or product information of the following materials shall be provided to the Landscape Architect from the supply source being used:
   a. Seed type and purity analysis.
   b. Sod type, growing conditions, and certification.
   c. Fertilizer specifications and guaranteed analysis.
   d. Mulch material components, chemical analysis, and manufacturer.
   e. Tackifier material components and manufacturer Flexterra® FGM, 1.800.508.8681 or approved equal.
   f. Flexible growth medium - Bonded Fiber Matrix (BFM) / hydromulch: Soil Guard by Justin Seed Company, 940-648-2751, or Flexterra® FGM, 1-800-508-8681, or an approved equal.
   g. Sod certification documentation to include the following:
      1) Kind – for example: Bermuda, etc…
      2) Variety – for example: Common, etc…
      3) Lot Number – If applicable
      4) Sod – Record of square feet shipped
      5) Bill of Lading / Invoice # - This is an invoice number that can be referenced to the purchaser of the shipment.
      6) Field # - the field number references the harvested grass to the production field. The field number must be the same as on the certification application and field inspection report.
      7) Harvest Date – Record the date the grass was harvested
      8) Grower Name and Address- Record the production company name and address. Use of a stamp is acceptable if it shows on all copies

C. Turf Soil: One (1) pound sample - “Top Dressing”, supplied by Soil Building Systems, Inc. telephone 972.831.8181, or approved equal.

D. Construction Schedule: At least two weeks prior to start of work, submit seeding or sodding schedule.

E. Maintenance: Submit three copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of the lawns for an entire year. Submit prior to Notice of Substantial Completion.

F. Qualification Data: For qualified landscape Installer.

G. Product Certificates: For soil amendments and fertilizers, from manufacturer.

H. Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil and imported or manufactured topsoil.

I. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Three (3) years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
      a. Certified Landscape Technician - Exterior, with installation, maintenance and/or irrigation specialty area(s), designated CLT-Exterior.
      b. Certified Turfgrass Professional designated CTP.
      c. Certified Turfgrass Professional of Cool Season Lawns designated CTP-CSL.
   5. Maintenance Proximity: Not more than two (2) hours' normal travel time from Installer's place of business to Project site.
   6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

   1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
   2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three (3) representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
   3. Report suitability of tested soil for turf growth.
      a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
      b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such

problem materials are present, provide additional recommendations for corrective action.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

A. Planting Restrictions: Plant grasses during the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
1. Warm season grasses: Between April 15 and September 1, or when the ground temperature is above 65 degrees Fahrenheit.
2. Cool season grasses: Between September 1 and April 15, when temperatures are above 40" F.
3. If grasses cannot be planted within the specified period, an alternative will be proposed by the Contractor.
4. Perform seeding using approved equipment.
5. A flexible growth medium (bonded fiber matrix) to be used with seeding application, apply at manufacturer’s recommendations.
    a. Soil Guard by Justin Seed Company, 940-648-2751, or Flexterra® FGM, 1-800-508-8681, or an approved equal.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
1. Seeded Turf: 90 days from date of Substantial Completion.
    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 90 days from date of Substantial Completion.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. Seed Type: Common Bermuda

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified sod including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Common bermuda grass

C. Seed Carrier: Inert material, sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
3. Provide lime in form of ground calcitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (12.5-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.6 PLANTING SOILS

A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D 5268 topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
1. Ratio of Loose Compost to Topsoil by Volume: 1:4.
2. Ratio of Loose Sphagnum Peat to Topsoil by Volume: 1:4.
3. Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:4.
4. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m): 2 pounds.
5. Weight of Sulfur per 1000 Sq. Ft. (92.9 Sq. m): 1 pound.
6. Weight of Agricultural Gypsum per 1000 Sq. Ft. (92.9 Sq. m): 15 pounds.
7. Volume of Sand Plus 10 Percent Diatomaceous Earth per 1000 Sq. Ft. (92.9 Sq. m): 20 pounds.
8. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m): 40 pounds.
9. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m): 5 pounds.
10. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): 6 pounds.
11. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): 6 pounds.

B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site or in-place surface soil. Verify suitability of topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Supplement with shall be “Enriched Top Soil”, supplied by Soil Building Systems, Inc. telephone 972.831.8181 or equal planting soil when quantities are insufficient.
2. Mix existing, native surface topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
   a. Ratio of Loose Compost to Topsoil by Volume: 1:4.
   b. Ratio of Loose Sphagnum Peat to Topsoil by Volume: !:4.
   c. Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:4.
   d. Revise first subparagraph below if a specific type of liming material (ground dolomitic limestone, calcitic limestone, mollusk shells, or other type) is required; coordinate with "Inorganic Soil Amendments" Article.
   e. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m): 2 pounds.
   f. Weight of Sulfur per 1000 Sq. Ft. (92.9 Sq. m): 1 pound.
   g. Weight of Agricultural Gypsum per 1000 Sq. Ft. (92.9 Sq. m): 15 pounds.
   h. Volume of Sand Plus 10 Percent Diatomaceous Earth per 1000 Sq. Ft. (92.9 Sq. m): 20 pounds.
   i. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m): 40 pounds.
   j. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m): 5 pounds.
   k. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): 6 pounds.
   l. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): 6 pounds.

2.7 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

F. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

G. Bonded Fiber Matrix: Profile™, www.profileevs.com or approved equal to be used for seeding application.

2.8 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1/2 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Apply fertilizer directly to subgrade before loosening.
   2. Spread topsoil; apply soil amendments and fertilizer on surface.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
      b. Mix lime with dry soil before mixing fertilizer.
   3. Spread planting soil to a depth of 4 inches (100 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
      a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.
      b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   2. Loosen surface soil to a depth of at least 6 inches (150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (100 mm) of soil. Till soil to a homogeneous mixture of fine texture.
      a. Apply fertilizer directly to surface soil before loosening.
   3. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
   4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3lb/1000 sq. ft. with a bonded fiber matrix (or flexible growth medium).

3.5 HYDROSEEDING (BFM / BONDED FIBER MATRIX)

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed (BFM / Bonded Fiber Matrix) application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate suggested by the manufacturer, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Plastic netting shall be removed and properly disposed of upon installation as shown in the following photo:

C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

D. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.7 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).

I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply sod as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass

blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

D. Turf height: Mow bermudagrass to a height of to 1 inch.

E. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect or client representative:
1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 95 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 3 by 3 inches (76 by 76 mm).
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

D. Repair existing lawns damaged by operations under the contract. Repair shall include finish grading, seeding or sodding as required to match existing grade and lawn, and maintenance of repaired areas.

3.12 GUARANTEE

A. All plant material shall be guaranteed by the contractor for a period of one (1) year from the date of final acceptance.

B. At the end of the guarantee period the Landscape Architect and Contractor shall inspect plant material. Any plant material under this contract that is dead or of an unsatisfactory growth condition shall be removed and replaced in a timely fashion by the contractor, at no cost to the owner.

3.13 ACCEPTANCE OF WORK

A. The contractor and Landscape Architect shall conduct an on site inspection of all work and materials to determine compliance of work with the construction documents.

B. The contractor shall within reasonable means provide the Landscape Architect with sufficient data to demonstrate compliance with the construction documents.

C. The contractor shall be notified in writing of any non-conforming items, which are to be corrected (punch-list).

D. The contractor and Landscape Architect shall conduct an on site inspection to verify completeness of punch list items.

E. Acceptance of work by the Owner shall begin upon verifying completion of punch list items and receipt of all deliverable items to Owner including letter of guarantee; release of liens waiver, record drawings denoting deviations from contract drawings, product data and maintenance guide.

F. The contractor shall receive written notification of date of final acceptance and ending date of required guarantee periods from the Landscape Architect.

END OF SECTION 32 92 00

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SECTION 32 93 00 – PLANTS

PART 1 GENERAL

WORK INCLUDED

A. Trees, shrubs, vines and ground cover as applicable.

B. Topsoil backfill.

C. Staking and guying.

D. Maintenance service.

1.1 RELATED WORK

A. Section 328400 – Planting Irrigation.

B. Section 329200 – Turf and Grasses.

1.2 REFERENCES

A. Standardized Plant Names, 1942 edition, American Joint Committee on Horticulture Nomenclature.

B. American Standard for Nursery Stock (ANSI Z60), latest edition, American Association of Nurserymen.

C. FS O-F-241 - Fertilizer, Mixed, Commercial.

1.3 QUALITY ASSURANCE

A. Perform work with personnel experienced in the work required of this Section under the direction of a skilled foreman.

B. Submit sources of plant materials. All materials to have name tags attached. Submit invoice with plant names noted if required.

C. Contractor shall locate all materials and be responsible for conformance with requirements of this Section. All plants not meeting requirements to be rejected.

D. Trees so noted on plant list will be reviewed at place of growth and tagged by Owner's Representative before digging. Contractor shall schedule review of plant material in such a manner that no single review period will exceed two consecutive working days with a maximum of two review periods. Should additional review periods be necessary the contractor shall compensate the Owner for two people at the rate of $95.00 per hour each plus cost of travel. Contractor shall be responsible for notification and coordination with all parties prior to scheduling review sessions. Notice to Owner's Representatives to be given minimum of seven days prior to review session.

E. All trees are to be reviewed by Owner’s Representative prior to planting.
   1. Trees will be reviewed at local growing or nursery site by Owner's Representative and approved before delivering to the site. Contractor shall schedule review of plant material in such a manner that no single review period will exceed one working day with a maximum of two review periods. Contractor shall be responsible for notification and coordination with all parties prior to scheduling review sessions.
   2. Prior to review by Owner's Representative, Contractor shall have pre-selected all trees and identified each with a "locking" tree tag. Additional tree tags will be provided by Contractor for changes at time of visit. Tree tags will have permanent, non-reproducible identifying notation unique to this project.

F. Submit topsoil source and analysis of topsoil to be retained on site or imported for backfill. Test performed by accredited soils laboratory. Submit soils test and recommendations for amendments including adjusting soil pH to a value between 6.0 and 7.0.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Move B&B plant materials with solid balls wrapped in burlap. Plants to be lifted only by ball or container.

B. Deliver plant materials immediately prior to placement. Keep plant materials not immediately installed moist and protect from freezing by covering ball or container with mulch. Any plants not planted within 2 days of delivery are to be heeled-in in a vertical position, root balls fully encompassed by mulch and a temporary watering system installed.

C. Reject plants when ball or container of earth surrounding roots has been cracked, broken or frozen preparatory to or during process of planting.

1.5 WARRANTY

A. Warrant all plants to be living, healthy specimens for a period of one year commencing upon Date of Substantial Completion. Warranty period shall terminate only if plants have been in full leaf for 30 days at end of warranty period. Termination of warranty period shall be extended as necessary to comply. All materials to be in vigorous condition at end of warranty period.

B. Immediately remove dead plants and plants not in a vigorous condition and replace as soon as weather conditions permit. Each replacement shall be covered with one-year warranty commencing at time of planting.

C. Replacements: Match with adjacent plants of the same species in size and form.

1.6 MAINTENANCE SERVICE

A. Begin maintenance of plant materials immediately after planting and continue until Date of Substantial Completion.

B. Maintenance shall include measures necessary to establish and maintain plants in a vigorous and healthy growing condition. Include the following:
   1. Cultivation and weeding of plant beds and tree pits. When herbicides are used for weed control, apply in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
   2. Watering sufficient to maintain optimum moisture level.
   3. Pruning, including removal of dead or broken branches, and treatment of prune wounds.
   4. Disease and insect control.
   5. Maintaining plants in an upright, plumb position, and repair of settling.
   6. Maintenance of wrappings, guys, turnbuckles and stakes. Adjust turnbuckles or otherwise keep guy wires tight. Repair or replace accessories when required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Trees, Shrubs, Vines, and Ground Cover: Species and size identified in plant list. Plant materials shall be true to name, in good health, free of disease and insects, excellent in form and in complete conformance with ANSI Z60. All materials to be nursery grown.

B. Topsoil: Friable loam, typical of cultivated topsoils locally, containing at least 2% of decayed organic matter (humus) secured from a well drained, arable site, reasonably free of subsoil, stones, earth clods, sticks, roots or other objectionable extraneous matter or debris and containing no toxic materials. Topsoil to have acidity range of 6.0 to 7.0. Soils tests and amendments as described herein.

C. Mulch: Shredded cedar, cypress or hardwood; dyed brown in color. Double ground hardwood bark mulch equal to that produced by Foster Brothers, Wood Products Inc. www.fosterbros.com. Submit type and source for approval.

D. Fertilizer: Osmocote slow release 18-6-12.

E. Soil acidifier: Equal to TIGER 90 CR Organic Sulphur 0-0-0-90.

F. Compost: "Back to Earth Composted Cotton Burrs", premium compost, course screened, as manufactured by Soil Mender Products, LP, www.soilmender.com.

G. Metal Edging: 3/16 inch x 4 inch steel landscape edging with steel stakes as manufactured by Col-Met, 3333 Miller Park South, Garland, Texas 75042, Phone 972/494-3900, www.colmet.com or approved equal.

H. Metal Tree Rings: 5 foot diameter fabricated from 1/8 inch X 4 inch steel strap. Metal shall be machine rolled to create true circles. Paint finish to be Ditzler Zinc Chromate Primer #DPE-1538 black. Stakes by manufacturer.

2.2 ACCESSORIES

A. Stakes: Green Metal Fence posts (3 per tree) - 6 foot height.

B. Hardware (cables, wire, eye bolts, and turnbuckles): Noncorrosive; of sufficient strength to withstand wind pressure.

C. Tie straps: Soft polypropylene material equal to ArborTie, by Deep Root Partners, L.P., 31 Langston St., Suite 4, San Francisco, CA, 94103, 1-800-277-7668.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify topsoil is ready to receive the work of this Section. All areas to be planted with shrub or ground cover masses to have minimum 12 inch depth of topsoil. Areas to be planted with Bamboo to have a minimum of 24” of topsoil.

B. Remove all weeds and grasses from planting beds. Bermuda grass, if present, to be exterminated by approved means or all soil removed to 6 inch depth and replaced with topsoil free of bermuda grass.

C. Stake tree locations and place shrubs, vines, and ground covers for review and final orientation by Owner's Representative prior to installation.

D. Outline bed edges for approval.

E. Prepare topsoil for shrub and ground cover beds, after removing any vegetation with approved procedure, by tilling 2 inch layer (165 CF per 1000 sq. ft.) of compost into the upper 6 inches of soil.

3.2 INSTALLATION

A. Excavate for plant materials. Tree pits shall be 8’ in diameter. Depth to be 18” min. or height of rootball, whichever is greater. Circle to be centered on tree and true in form. Entire shrub bed areas to be excavated to a min. 12” depth and backfilled with topsoil. Remove all subsoil, rock, and debris from site. Remove all excavated material from site.

B. Tree pits shall remain open with appropriate safety protection for approval by Owner’s Representative before backfilling.

C. Tree pits to be filled with approved topsoil before planting of trees. Amendments as required by soils test and as approved by Owner’s Representative to be thoroughly incorporated to 8” depth by tilling prior to planting of tree.

D. Set trees with root flare 4 inches above surrounding grade, and other plant materials level with surrounding grade, after settlement.

E. Remove containers from container-grown stock. Set plants in center of pits and backfill with topsoil in 6 inch layers. Pull away ropes, wires, etc. from the top of the ball.

F. Remove any soil from the top of the rootball, to the level of the root flare.

G. Final 6 inch layer of backfill around trees to consist of 1:1 mixture of compost and topsoil.

H. Thoroughly water soil when the hole is half full, and again when full.

I. Apply 1/2 pound fertilizer evenly over cultivated area around each tree and 1 pound per 100 square feet to shrub and ground cover plantings.

J. Evenly spread a 3 inch layer of mulch over tree pits and planting beds.

K. Prune trees and shrubs after planting to improve form and to remove dead and broken branches.

L. 8’ diameter circular area around trees to be mulched and free of vegetation. For trees 2 inch and greater in caliper, area to be 8 feet in diameter. For trees less than 2 inch caliper, area to be 6 feet in diameter. Circle to be centered on tree and true in form.

M. After planting trees, form a 3’ diameter ridge of topsoil around edge of excavation to retain water. Ridge to be removed by the Contractor at the One Year Warranty review, and mulch replaced in the area of the ridge.

N. Place bare root plant materials so roots lie in a natural position. Backfill topsoil in 6 inch layers. Maintain plant materials in vertical position.

3.3 PLANT SUPPORT

A. Brace plants upright in position by staking and guying as detailed. Guys to be secured to tree with loops as detailed. All tree staking to be removed by the Contractor at the One Year Warranty review, unless otherwise directed by the Owner, with the stakes becoming the property of the Contractor.

3.4 LANDSCAPE EDGING

A. Install edging in locations shown on Drawings.

A. Edging to be set vertical with top edge 1 inch above grade.

B. Secure edging with metal stakes provided by manufacturer.

C. Horizontal alignment to be true with straight lines and smooth, unbroken curves.

END OF SECTION 32 93 00

METCO
MIDWEST ENGINEERING & TESTING CORPORATION

GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

PROPOSED CANADIAN COUNTY FAIRGROUND PROJECT
S. ALFADALE ROAD AND E. JENSEN ROAD
EL RENO, CANADIAN COUNTY, OKLAHOMA

Prepared for
CANADIAN COUNTY
201 NORTH CHOCTAW ROAD
EL RENO, OKLAHOMA 73036

Prepared by
MIDWEST ENGINEERING AND TESTING CORPORATION
2025 S. NICKLAS, SUITE 115
OKLAHOMA CITY, OKLAHOMA 73128

405-681-6737

METCO PROJECT NO: OGR-19071

JULY 2019

METC
Midwest Engineering and Testing Corporation

July 19, 2019

Canadian County
201 North Choctaw Road
El Reno, Oklahoma 73036
Phone: 405-295-6000
Fax: 405-422-2429

Attention: Mr. Dave Anderson, Commissioner District 2

Subject: Geotechnical Engineering Services Report
Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma
METCO Project No: OGR-19071

Dear Mr. Anderson:

Midwest Engineering and Testing Corporation (METCO) is pleased to submit this Geotechnical Engineering Services Report for the above-referenced project. The purpose of our services was to assist the design team in designing foundation and general pavement systems and preparing plans and specifications for construction of the proposed project. Our services were completed in general accordance with the scope of work as outlined in METCO proposal number OGP-19079 dated May 9, 2019. Written authorization was provided by Mr. David Anderson, Chairman, of Board of Canadian County Comm. on May 20, 2019. A summary report along with our formal detailed geotechnical engineering services report is enclosed for your review. **The entire report should be read in its entirety prior to utilizing any of the presented information for design or construction purposes.**

Executive Summary

A total of 7 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by Canadian County, the borings were drilled within the general vicinity of the proposed new construction areas. These borings were drilled to approximate depths of 11.5 feet to 25.0 feet below existing grade. Location and depth of the borings were selected by Canadian County. Locations of the proposed new construction as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Indications of possible fill soils were not encountered in the borings. **However, fill soils may exist to various depths at other site locations**. Below approximately 3.0 inches to 4.0 inches of grass and topsoil, the borings generally encountered soils consisting of clay to approximate depths of 11.5 feet to 20.5 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 7 to 57 blows per foot (bpf) of penetration indicating firm to hard consistencies in the cohesive soils. Below the upper soils and extending to boring termination depths of approximately 25.0 feet below existing grade, the deeper building borings encountered soft to hard shale.

Based on laboratory testing, the subsurface tested soils are susceptible to moderate to high swell potential.

Groundwater was encountered in the deeper building borings, at approximate depths of 10.5 feet to 17.0 feet below existing grade at the time of drilling, end of day and/or within 24 hours of completion of drilling. Groundwater was not encountered in the remaining borings B-6 and B-7 at completion of drilling and end of day. **However, it is possible that transient saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. It is strongly recommended that the contractor determine the actual groundwater levels prior to construction.**

Summary of Recommendations

In general, we recommend that all structural improvement areas be drained of any surface water, and stripped of topsoil materials, if any, **existing underground and/or overhead utilities, if any existing fill, if any, soft soils, any organic material,** any asphalt, any concrete, any gravel, if any, any old foundations, old underground storage tanks or basements, if any, burn pits, if any, and any other deleterious materials encountered at the time of construction. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the swell/collapse of the upper soils. Following the removal of all unsuitable onsite debris and vegetation and excavation to the proposed subgrade level, the construction area should be proof-rolled with a tandem axle dump truck or similar rubber-tired vehicle. Soils which are observed to rut or deflect excessively under the moving load should be undercut; moisture conditioned and re-compacted in place or replaced with properly compacted fill. **Over excavation of such soils could extend to several feet below the exposed subgrade level.** The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. **After proof-rolling is completed and any soft areas or areas exhibiting rutting or pumping are properly corrected**, the subgrade soils should be scarified and compacted, at the optimum moisture content to +3 percent of the optimum moisture content, to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8-inches below the exposed surface. Fill soils should be placed in 8-inch loose lifts and compacted to at least 95% of maximum dry density as determined by ASTM Designation D 698 at -1 percent of optimum moisture content to +3 percent of the optimum moisture content.

Based on the results obtained from our exploration and analysis, the proposed building can be supported on conventional shallow spread footings **founded on existing non-expansive stiff soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill**. Shallow spread footings for building columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,000 and 1,600 pounds per square foot, respectively at a minimum depth of 24 inches below final grade. **A gravel base may be required depending on the actual soil conditions at the time of construction. Proper observation of the footing excavations by METCO representatives is essential for the performance of the structure. Once the final design and grading plans are complete, METCO should be contracted for additional analysis**.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

As an alternate foundation system, a drilled pier and grade beam foundation system can be used for support of the column loads and wall loads, respectively. The base of the drilled piers should bear a minimum of 3.0 feet or one pier diameter, **whichever is deeper**, into the rock strata. The rock strata were encountered in the deeper building borings at approximate depths of 15.5 feet to 20.5 feet below existing grade. **However, the rock strata depths may significantly vary across the site**. The drilled piers can be designed for a maximum allowable end bearing pressure of 20,000 psf, based on dead plus design live loads. An allowable skin friction of 2,000 psf can be utilized for that portion of the pier extending more than 3 feet or one pier diameter, whichever is deeper, into the rock strata. **The bearing strata depths should be verified prior to construction. Difficulties might be encountered during drilling due to the nature of the subsurface formation. Additional drilling should be performed prior to final design and construction. The drilled piers should be at least 3 pier diameters deep.**

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

The weathering process of shale is erratic and variations in the shale profiles can be expected in small lateral distances.

It should be noted that TCP results in the bore holes ranged from 1.3 inch for 100 blows to 4.0 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

The piers should be reinforced for their full depth with reinforcing steel. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the soils based on soil adhesion of 900 psf over the upper 10 feet of the pier shaft. Soft or loose soil encountered at the bearing level should be removed. All loosened soils should also be removed. If personnel entry into the shaft is required, a 30-inch minimum diameter is recommended.

A slump of 5 to 7 inches is desired to reduce the potential for forming of voids as the casing is extracted and groundwater related problems. Foundation excavations should be filled with concrete as soon as possible to reduce the potential of groundwater related problems. **To reduce difficulties associated with sloughing and/or groundwater related problems and to facilitate observation, the use of temporary casing might be required.**

Grade beams can be supported on a minimum of 6-inch void space between the bottom of the beams and the underlying soils. Cardboard forms can be used to provide the required void space. Care must be taken to maintain the integrity of the cardboard boxes up to the time the concrete is placed. Wet, damaged, or poorly constructed void boxes may collapse under the weight of the concrete.

The floor slab can be grade supported on a minimum of 3.0 feet of properly compacted and tested, non-expansive structural fill materials. Proof rolling, as discussed in this report, should be accomplished to identify any soft or unstable soils, which should be removed from the floor slab area prior to new fill placement and/or floor slab construction.

It is recommended that free draining granular mat be placed beneath the floor slab to enhance drainage and provide increased subgrade strength. Polyethylene sheeting should be placed on

the granular mat to act as a vapor barrier. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage. The floor slab should not be rigidly connected to columns, walls, or foundations, if possible. **Detailed floor slab recommendations are presented in section 5.5 of this report.**

Although fill material was not observed in the borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction areas. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted and tested low plasticity structural fill.**

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The scope of services did not include an environmental site assessment for determining the presence or absence of toxic or hazardous materials in the soil, surface water, groundwater, or air on, below, or around the site. Any statements regarding colors, odors, suspicious, or unusual items are strictly for informational purposes. Prior to further development of this site, an environmental assessment is advisable.

General

The attached entire report should be read and the contents evaluated prior to utilizing our recommendations in the preparation of the design and construction documents. Please refer to the attached report for a more detailed summary of our analysis and recommendations. It is recommended that METCO be retained to provide observation and testing services during construction. Please do not hesitate to contact our office at 405-681-6737.

Respectfully Submitted,

Midwest Engineering and Testing Corporation
CA No. 4198, Expires 06/30/2021

Shafe Saad Aldin, E.I.
Engineer Intern

Nasir Marakah, P.E.
President

Table of Contents

Geotechnical Engineering Services Report
Proposed Canadian County Fairground Project
S. Alfadale Road and E. Jensen Road
El Reno, Canadian County, Oklahoma
METCO Project No: OGR-19071
July 2019

1.0 Introduction

Midwest Engineering and Testing Corporation (METCO) has completed a geotechnical exploration and evaluation of the subsurface conditions for the above-referenced project site in general accordance with the scope of work as outlined in METCO proposal number OGP-19079 dated May 9, 2019. Written authorization was provided by Mr. David Anderson, Chairman, of Board of Canadian Comm. on May 20, 2019.

2.0 Project Description

Based on project information provided, we understand the proposed construction will consist of the following:

Building	New Single-Story Buildings Without Basements Ground Supported Floor Slabs Less than 60 Kip Column Loads, 3.0 KLF Continuous Loads
Grading	Less Than 2 Feet of Cut/ Fill, Each at The Proposed Building Areas
Pavement	Asphaltic Concrete and/or Rigid Pavement

Once the final grading plans are available, METCO should be contracted for additional analysis. Modifications to the presented recommendations may be warranted and should be expected based on the final grading plans. Ground elevations at the boring locations should be determined by others prior to any grading activities.

If potential settlements cannot be tolerated, crushed stone should be used to backfill and deep fill areas to within 5 feet of final grade.

If some settlements can be tolerated, material such as GW, GM, SW, SM and SC with a plasticity index (PI) of 9 or less should be used to backfill any deep fill areas to approximately 5.0 feet below final grade. Select fill should be placed in loose 6-inch lifts and should be compacted, at 1 percent below optimum to 3 percent above the optimum moisture content, to 98 percent of the modified Proctor maximum dry density ASTM D1557. Any placed fill should be monitored prior to and during construction.

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavations or on prepared subgrade of the construction areas either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

If the groundwater levels are expected to be near the expected excavation levels in the proposed construction areas, dewatering prior to and after construction will be required.

The design engineer should consider the effects of groundwater. A comprehensive drainage system should be designed to prevent the damages to the proposed structure, if deemed necessary by the design engineer.

It should be noted that TCP results in the bore holes ranged from 1.3 inch for 100 blows to 4.0 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

The location of the site is shown on the Site location Map.

3.0 Scope of Work

The purpose of this exploration and evaluation was to assess the subsurface soil conditions at the project site, at the boring locations, in order to help in the evaluation of acceptable foundation and general pavement systems for the proposed project.

Our scope of services included the items presented in the following sections.

3.1 Subsurface Exploration

A total of 7 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by Canadian County, the borings were drilled within the general vicinity of the proposed new construction areas. These borings were drilled to approximate depths of 11.5 feet to 25.0 feet below existing grade. Location and depth of the borings were selected by Canadian County. Locations of the proposed new construction as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Soil samples were taken at regular intervals during the drilling process. Samples were identified in the field, placed in sealed plastic bags, and transported to the laboratory for further classification and testing.

When the split spoon sampler was used, Standard Penetration Tests (SPT's) were performed at regular intervals in general accordance with ASTM Designation D1586, samples collected, and results presented on the boring logs. The SPT used in soil borings is performed by driving a 2-inch, O.D., split-spoon sampler into the undisturbed formation located at the bottom of the advanced auger with repeated blows of a 140-pound, pin-guided, hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler one foot is a measure of the soil consistency.

When the Texas Cone Penetration test was used to evaluate the bedrock, the cone was driven into the bedrock material with a 140-pound automatic hammer that falls 30 inches. After the cone was seated, the distance the TCP is driven was recorded after each of two 50 blow counts.

3.2 Laboratory Evaluation

Selected samples of the subsurface soils were tested in the laboratory to determine materials properties for further evaluation and approximate unified soil classifications were determined by visual inspection. The laboratory evaluation consisted of visual and textural examinations,

moisture content, Atterberg limit tests and percent passing the No. 200 sieve. Results of the tests are shown on the attached logs of borings and in the appendix.

3.3 Engineering Analysis

Engineering analysis and recommendations regarding general foundation design including allowable soil bearing pressures, minimum depth requirements, and estimates of foundation settlement are included in this report. In addition, recommendations were developed addressing site preparation, placement and compaction of fill materials, and site preparation of the floor slab areas.

This geotechnical engineering report presents recommendations derived from existing and available information pertaining to the proposed project; relevant laboratory data, information, and test results; subsurface materials encountered in our borings, and the proposed new construction locations. The attached entire report should be read and the contents evaluated so that to facilitate any changes that may be desired. If any changes or corrections are desired, please inform METCO in writing so that we may amend the presented recommendations.

METCO cannot be responsible for the interpretation or implementation of this report by others. METCO should be retained to provide observation and testing during construction. Foundations, earthwork, and all other construction related activities should be observed by METCO. METCO will not accept any responsibility for the performance of the subgrade, foundations, any structure or pavement for this project nor will it accept any responsibility for any conditions which deviated from those described in this report.

4.0 Surface and Subsurface Features

4.1 Site Description

The subject property is approximately located at the northwest corner of the intersection of S. Alfadale Road and E. Jensen Road in El Reno, Canadian County, Oklahoma. The proposed construction area was covered with grass and visually appeared to be relatively level with a gentle slope to the south and southwest. Some utilities and buildings existed in the general vicinity of the proposed construction areas. The surface conditions were relatively dry and our truck-mounted drill rig experienced no difficulty in moving around the site.

4.2 Soil Subsurface Conditions

Indications of possible fill soils were not encountered in the borings. **However, fill soils may exist to various depths at other site locations**. Below approximately 3.0 inches to 4.0 inches of grass and topsoil, the borings generally encountered soils consisting of clay to approximate depths of 11.5 feet to 20.5 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 7 to 57 blows per foot (bpf) of penetration indicating firm to hard consistencies in the cohesive soils. Below the upper soils and extending to boring termination depths of approximately 25.0 feet below existing grade, the deeper building borings encountered soft to hard shale.

Laboratory tests indicated that the site soils had plasticity indices ranging from 13 to 29 and grain size distribution tests show that the tested soils contain about 72 to 98 percent fines (that material passing a No. 200 mesh sieve). The encountered soils were classified as CL in accordance with the Unified Soil Classification System.

Based on the results of our laboratory-tests and our experience with other sites in the general vicinity, the on-site tested soils are susceptible to moderate to high swell potential. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the collapse/swell of the upper soils.

Although fill material was not observed in the borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction areas. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted and tested low plasticity structural fill.**

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The above description of the subsurface conditions constitutes a generalization that emphasizes the subsurface stratification features and characteristics. The data and information at the specific boring locations are recorded in the boring logs. These logs present a description of subsurface soil and rock, applicable laboratory and field test results, sample location, and general stratification. Variations in the stratification presented in the boring logs should be expected across the site and between boring locations as the presented strata description is only indicative of the boring locations.

4.3 Groundwater

Groundwater was encountered in the deeper building borings, at approximate depths of 10.5 feet to 17.0 feet below existing grade, at the time of drilling, end of day and/or within 24 hours of completion of drilling. Groundwater was not encountered in the remaining borings, borings B-6 and B-7, at completion of drilling and end of day. **However, it is possible that transient saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. It is strongly recommended that the contractor determine the actual groundwater levels prior to construction.**

4.4 Seismic Considerations

IBC Seismic Zone Coefficients

Earthquake related design parameters may be obtained from the International Building Code 2015 Edition, using *a Site Class **C** Definition.*

If site-specific earthquake response spectra or other specific design parameters are deemed necessary by the project structural engineer, or are required by the local governmental agency

who has jurisdiction over the project, the geotechnical engineer should be promptly informed so that the appropriate analysis can be performed. In addition, design of structures should comply with the requirements of the governing jurisdiction's building codes and standard practices of Oklahoma.

5.0 Evaluation and Recommendations

Based on the results of our fieldwork, laboratory evaluation, and engineering analysis, the proposed building can be supported on shallow spread footings **founded on exiting stiff non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill** at a minimum depth of 2.0 feet below final grade.

As an alternate foundation system, the proposed building can be supported on a drilled pier foundation system bearing a minimum of 3.0 feet or one pier diameter, whichever is deeper, in the rock strata. Other types of foundation systems can be evaluated, if desired.

Once the final grading plans are available, METCO should be contracted for additional analysis. Modifications to the presented recommendations may be warranted and should be expected based on the final grading plans. Ground elevations at the boring locations should be determined by others prior to any grading activities.

If potential settlements cannot be tolerated, crushed stone should be used to backfill and deep fill areas to within 5 feet of final grade.

If some settlements can be tolerated, material such as GW, GM, SW, SM and SC with a plasticity index (PI) of 9 or less should be used to backfill any deep fill areas to approximately 5.0 feet below final grade. Select fill should be placed in loose 6-inch lifts and should be compacted, at 1 percent below optimum to 3 percent above the optimum moisture content, to 98 percent of the modified Proctor maximum dry density ASTM D1557. Any placed fill should be monitored prior to and during construction.

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction areas either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

If the groundwater levels are expected to be near the expected excavation levels in the proposed construction areas, dewatering prior to and after construction will be required. The design engineer should consider the effects of groundwater. A comprehensive drainage system should be designed to prevent the damages to the proposed structure, if deemed necessary by the design engineer.

It should be noted that TCP results in the bore holes ranged from 1.3 inch for 100 blows to 4.0 inches for 100 blows. **All contractors should review the boring logs and make their own conclusions in regards to the rippability of the rock formations.**

Generally, similar structures as that proposed are designed for post-construction vertical slab movements of less than 1 inch. Consideration must be given to the presence of moderately plastic clays within the proposed construction areas. These soils may exhibit significant

volumetric changes with changes in their moisture content. We estimate the potential vertical rise (PVR) to be on the order of 2.3 inches. These movements are based on the worst-case dry soil conditions. It was estimated that the PVR for a floor slab supported on a minimum of 3.0 feet of low plasticity structural fill to be on the order of less than 1 inch.

5.1 Site Preparation

Typically, it is recommended that prior to general site grading, **all topsoil, any existing fill material, any organic material, any underground utilities and/or overhead utilities,** existing concrete, if any, asphalt, gravel, any old foundations, any old underground storage tanks, if any if any, and any other deleterious materials encountered at the time of construction **and soft soils** should be stripped from the proposed construction area. The depth of required removal should be evaluated by a representative of the geotechnical engineer at the time of construction. The resulting excavations should be widened, as necessary, to allow access to compaction equipment. **The site was cleared prior to our field activities.**

Once the proposed subgrade level has been exposed, the construction area should be proof-rolled during a period of dry weather. **A representative of the geotechnical engineer should observe the exposed subgrade for soils that rut or deflect under the moving load.** Such soils should be recompacted or replaced with properly compacted fill. **Over excavation of such soils could extend to several feet below the exposed subgrade level. Stabilization of the subgrade soils and/or a gravel base may be required depending on the actual soil conditions at the time of construction. After proof-rolling is completed and any soft areas or areas exhibiting rutting or pumping are properly corrected**, the top 8 inches of the exposed subgrade should be scarified; moisture conditioned, if necessary, and compacted, at the optimum moisture content to +3 percent of optimum moisture content, to 95 percent of the standard Proctor maximum dry density ASTM D698.

Any fill should have a liquid limit of 35 or less and a plasticity index of 5 to 15, be 3 inches or less in particle size, and should be free of organic or any deleterious materials. Fill should be placed in loose 8-inch lifts and should be compacted at 1 percent below optimum to 3 percent above the optimum moisture content. The first layer of fill material should be placed in a relatively uniform horizontal lift and be keyed into the prepared subgrade soils.

Based on the laboratory test results, most of the on-site tested soils are not-suitable for use as structural fill. However, these soils should be tested in bulk at the time of construction. If a fine-grained clay soil is used for fill, close moisture content control will be required to achieve the recommended degree of compaction. If water is added, it should be uniformly applied and thoroughly mixed into the soil. Structural fill should be compacted to at least 95 percent of standard Proctor maximum dry density as determined by ASTM Designation D 698.

It is recommended that each compacted-engineered lift be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. It is also recommended that the compacted fill be extended 5 feet beyond the edges of the building.

5.2 Foundation Support

Based on the results obtained from our exploration and analysis, the proposed structures can be supported on conventional shallow foundation systems. Shallow spread footings for building

columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,000 and 1,600 pounds per square foot, respectively, **bearing on existing stiff non-expansive soils or on a minimum of 3.0 feet of properly compacted and tested engineered fill at a minimum depth of 24 inches below final grade**. To reduce the possibility of local bearing capacity failure, minimum dimensions of 24 inches for column footings and 18 inches for continuous footings should be used in foundation design. The footings should be provided with appropriate reinforcement as determined by the structural engineer. **Proper observation of the footing excavations by METCO representatives is essential for the performance of the structure. Once the final design and grading plans are complete, METCO should be contracted for additional analysis.**

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

A one third increase in bearing value can be used for wind and seismic load considerations. Since the recommended bearing value is a net value, the weight of the concrete in the footings may be assumed to be 50 pounds per square foot. The weight of the soil backfill may be neglected for downward load contribution.

A representative of METCO should observe the foundation excavations prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. **Soft or loose soil zones encountered at the bottom of the footing, excavations should be removed to the level of stiff or dense soil as directed by the geotechnical engineer.** Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with engineered fill, as determined by the geotechnical engineer. METCO should be contacted to evaluate moisture issues, if needed.

An ultimate coefficient of friction of 0.47 can be used between the base of footings and the floor slab and the supporting soils to resist lateral loads. In addition, lateral loads can be resisted by a uniform ultimate passive key resistance of 130 pounds per square foot, for keys embedded at least 2.0 feet below final grade. A one third increase in the passive value can be used for wind and seismic loads. The frictional resistance and the passive resistance of the soils can be combined without any reductions in determining the total lateral resistance.

We estimate that foundations designed and constructed in accordance with the above recommendations will experience total settlements generally less than 1-inch with differential settlements generally less than ¾ inches within the building area. **It should be noted that additional settlements of approximately 1 to 2 percent of placed fill height should be accounted for in the design**. Consolidation testing was beyond the scope of this exploration.

5.3 Alternate Foundation System

As an alternate foundation system, a drilled pier and grade beam foundation system can be used for support of the column loads and wall loads, respectively. The base of the drilled piers should bear a minimum of 3.0 feet or one pier diameter, **whichever is deeper**, into the rock strata. The rock strata were encountered in the deeper building borings at approximate depths of 15.5 feet to 20.5 feet below existing grade. However, **the rock strata depths may significantly vary at other site locations**. The drilled piers can be designed for a maximum

allowable end bearing pressure of 20,000 psf, based on dead plus design live loads. An allowable skin friction of 2,000 psf can be utilized for that portion of the pier extending more than 3 feet or one pier diameter, whichever is deeper, into the rock strata. **The bearing strata depths should be verified prior to construction. Difficulties might be encountered during drilling due to the nature of the subsurface formation. Additional drilling should be performed prior to final design and construction. The drilled piers should be at least 3 pier diameters deep.**

The weathering process of shale is erratic and variations in the shale profiles can be expected in small lateral distances.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner and/or contractor.

The piers should be reinforced for their full depth with reinforcing steel. Reinforcement quantity should be adequate to resist tensile uplift forces generated by the soils based on soil adhesion of 900 psf over the upper 10 feet of the pier shaft.

Soft or loose soil encountered at the bearing level should be removed. All loosened soils should also be removed. If personnel entry into the shaft is required, a 30-inch minimum diameter is recommended.

Pier excavations should be observed by a representative of the geotechnical engineer to assess that the foundation soils have adequate strength to support the design loads and are consistent with the soil encountered in our borings. **To reduce difficulties associated with sloughing and/or groundwater related problems and to facilitate observation, the use of temporary casing might be required.**

A slump of 5 to 7 inches is desired to reduce the potential for forming of voids as the casing is extracted. Foundation excavations should be filled with concrete as soon as possible to reduce the potential of groundwater related problems.

Installation of a test pier during the design stage can be beneficial. The installation of a test pier can aid in the evaluation of potential difficulties that might occur during construction and in verifying the depth of the bearing formations.

5.4 Grade Beams

Grade beams can be supported on a minimum of 6-inch void space between the bottom of the beams and the underlying soils. Cardboard forms can be used to provide the required void space. Care must be taken to maintain the integrity of the cardboard boxes up to the time the concrete is placed. Wet, damaged, or poorly constructed void boxes may collapse under the weight of the concrete. It is recommended that suitable rigid protection be installed along the outer and inner edges of the grade beams to prevent backfill material from collecting in the void space beneath the grade beams.

5.5 Floor Slab Recommendations

Floors slabs can be grade supported on a minimum of 3.0 feet of properly compacted and tested, non-expansive structural fill materials. **Floor slabs should be supported directly by 4.0 inches to 6.0 inches of Aggregate Base Course (ABC); over 32.0 inches to 30.0 inches, respectively of non-expansive soil meeting the requirements outlined above.** This material will act as a leveling base and aid in concrete curing. This material will not act as a positive moisture break to prevent moisture rise to the slab. If the floor covering is considered moisture sensitive, plastic sheeting should be placed over the base course. **Any existing fill should be removed prior to fill placement and/or floor slab construction.**

A modulus of subgrade reaction (k) of 100 pounds per cubic inch is recommended for floor slabs overlying the graded gravel base and a compacted subgrade. The floor slabs should have an adequate number of joints to reduce cracking resulting from possible differential movements. The floor slabs should not be rigidly connected to columns, walls, or foundations, if possible. **Floor slab design is not typically the area of expertise of the Geotechnical Engineer and should be verified by the Structural Engineer of Record.**

All construction activity may cause damage and deterioration to the prepared subgrade. We recommend our field representative observe the final subgrade prior to placement of the slab on grade, and perform further testing as necessary.

5.6 Pavement Recommendations

We have assumed typical area soil parameters for pavement design. Our study did not include CBR testing or detailed pavement analysis for the subgrade soils or imported soils. A more detailed analysis of the subgrade and traffic conditions should be made in large areas of pavement, or where pavements are subject to significant traffic. The results of such analysis will provide the needed information for the design of an economical and serviceable pavement. **The project civil engineer should design the actual pavements based on site-specific traffic information.**

The pavement thicknesses presented in the table below are considered area typical and minimum for the assumed parameters. Thinner pavement sections than those presented in the table might be warranted due to budgetary considerations. However, Canadian County, and all parties involved should be aware that increased maintenance costs and lower pavement life might be expected with thinner pavement sections. The subgrade should be prepared as recommended in this report.

With an assumed CBR value of 3, a typical standard pavement section consisting of the following could be used:

Asphalt Concrete Flexible Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways
Asphaltic Surface Course	2"	2"
Asphaltic Binder Course	3"	5"
Crushed Stone Base	8"	8"

Concrete Rigid Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways, trash dumpsters area, areas of large loads from small steel wheels
Concrete Pavement	5"	7"
Crushed Stone Base	8"	8"

Providing the proper pavement type and thickness will result in better distribution of surface loads to the subgrade without causing deformation of the surface. Proper compaction, fine grading and proof-rolling should supercede pavement placement. The work should be done in accordance with Oklahoma State Department of Transportation guidelines or other applicable guidelines.

The base stone should not get saturated and water should not be allowed to pond behind curbs. To allow water entering the base stone a path to exit, base stone should extend through the slope in down grade areas.

The pavement concrete should have a compressive strength of at least 3,500 psi with 3% to 6% air entrainment. This concrete should be saw-cut as directed by the design engineer. The pavement should be adequately reinforced with steel. As minimum, the reinforcement steel should be No. 3 bars on a maximum spacing of 18 inches each way. The final pavement section should be designed by the Civil Engineer.

5.7 Lime/ Fly Ash Stabilization

Consideration should be given to lime/fly ash stabilization to improve the parking and driveway subgrade soils. Stabilizing the top 8 inches of the subgrade soil in the parking and driveway areas, will improve the subgrade soils. **The actual lime/fly ash percentage should be determined at the time of construction.**

Sulfate tests and other appropriate tests should be performed prior to the final selection of the stabilizing material.

5.8 Drainage Considerations

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction area either during or after construction. Excessive settlement could result if water is allowed to collect in foundation excavations or on prepared subgrade of the construction areas.

Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, or positive run-off. The contractor should exercise care in creating drainage paths for water during the construction phase of the project. Curbing adjacent to landscaped areas should be designed deep enough to act as a barrier between the landscape irrigation and the subgrade soil. Surface run-off from roofs, parking areas, etc., should be discharged away from the structures. To reduce infiltration of surface water around the

perimeter of the building and beneath the floor slabs, positive drainage should be provided. If groundwater issues are encountered during construction, METCO should be contacted.

5.9 Excavation and Temporary Slopes

The contractor, designated as "responsible person" in OSHA Construction Standards for Excavations, 29 CFR Part 1926, is solely responsible for planning and implementing all safety procedures. All excavation height, slope, and depth must adhere to all specifications outlined in local, state, and federal safety regulations.

METCO does not assume any responsibility for construction site safety or any party's, including the contractor, compliance with the applicable local, state, and federal safety regulations or any other applicable regulations.

5.10 Trench Backfill

All required trench backfill should be mechanically compacted in layers to at least 95% of the standard Proctor maximum dry density as determined by ASTM Designation D 698. Some settlement of the backfill may be expected and any utilities within the trenches or concrete walks supported on the trench backfill should be designed to accept these differential movements.

5.11 Weather Considerations

The upper soils encountered at this site may be sensitive to moisture variations and construction traffic disturbances during wet weather. The soil strength is significantly reduced when the soil is wet and significant delays in the grading and compaction activities can take place. Thus, it is advantageous to perform construction activities during periods of dry weather.

5.12 Construction Monitoring

METCO should be retained to provide observations and testing of soil exposures created during project construction in order to verify that soil conditions are as anticipated and are as encountered in our borings. Construction activities pertaining to earthwork, foundations, and all other related activities should also be observed by METCO representatives. METCO cannot accept any responsibility for the performance of the subgrade, foundations, any structure or pavement for this project. Furthermore, METCO cannot accept any responsibility for conditions which deviated from those described in this report.

6.0 General

The conclusions and recommendations presented in this report are subject to the following general conditions:

6.1 Use of Report

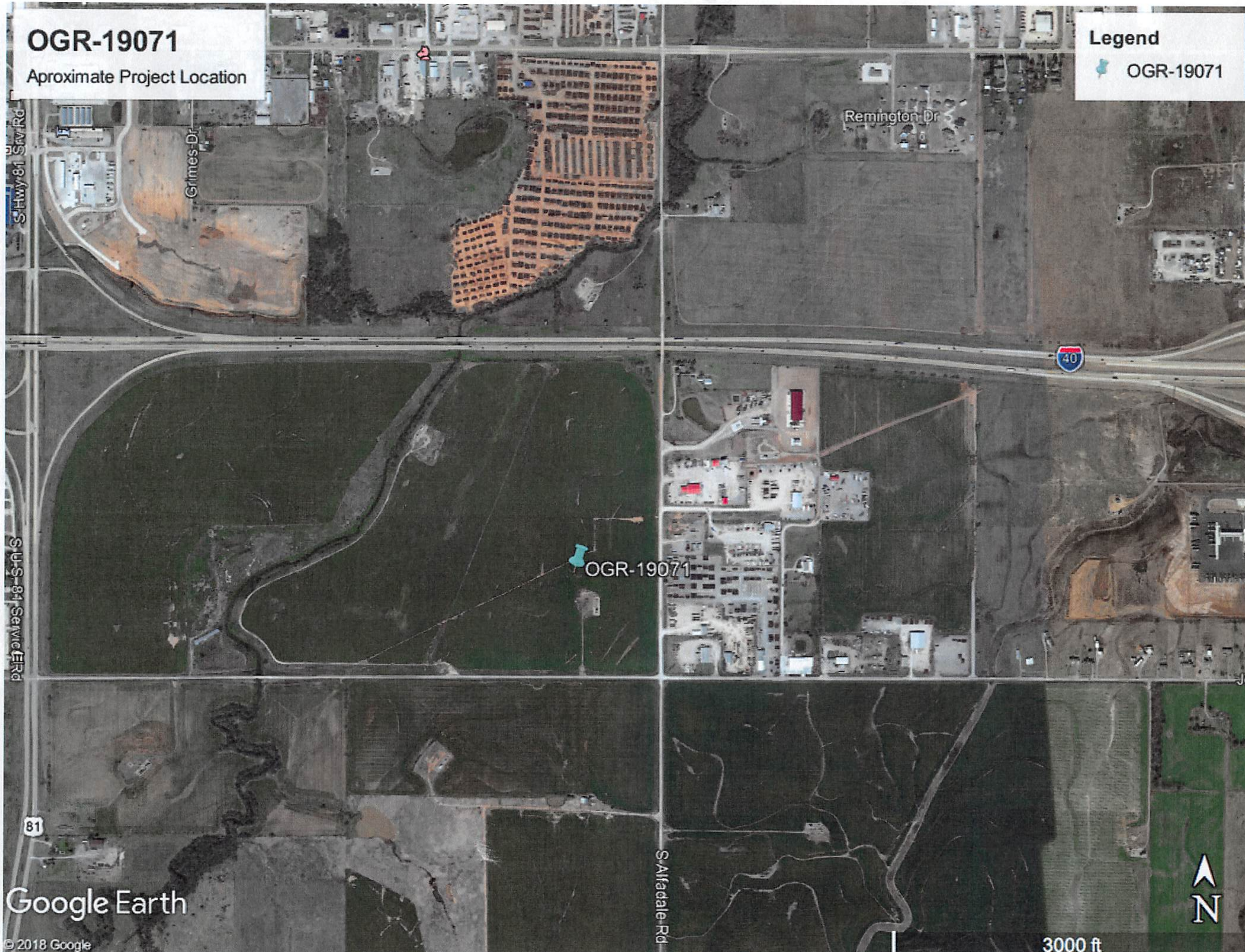
This report has been prepared for the exclusive use of Canadian County, for the specific application for the Proposed Canadian County Fairground Project, located at the northwest corner of S. Alfadale Road and E. Jensen Road in El Reno, Canadian County, Oklahoma. This report should not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us. Unless our written approval is provided, we make no representation and assume no responsibility to other parties regarding this report.

6.2 Level of Care

The recommendations contained in this report are based on the available subsurface information obtained by METCO, and design details furnished for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, METCO should be notified immediately to determine if changes in the foundation recommendations are required. If METCO is not retained to perform these functions, METCO will not be responsible for the impact of those conditions on the project.

Services performed by the geotechnical engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. **No warranty, expressed or implied, is made**.

APPENDIX


OGR-19071
Aproximate Project Location
Legend
OGR-19071
Remington Dr
Grimes Dr
S Hwy 81 Srv Rd
S U S 81 Service Rd
40
81
OGR-19071
S Alfadale Rd
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Google Earth
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3000 ft
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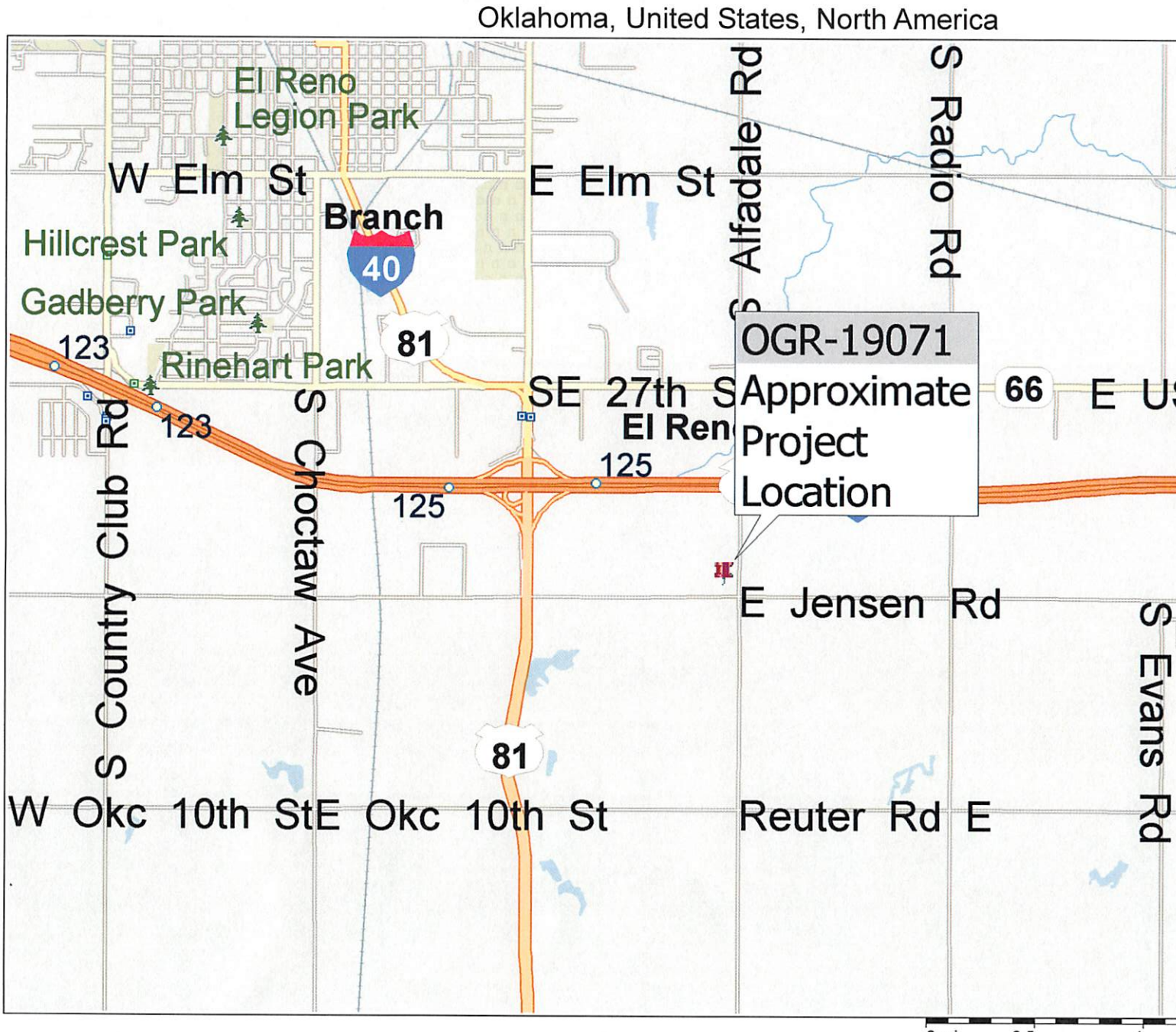

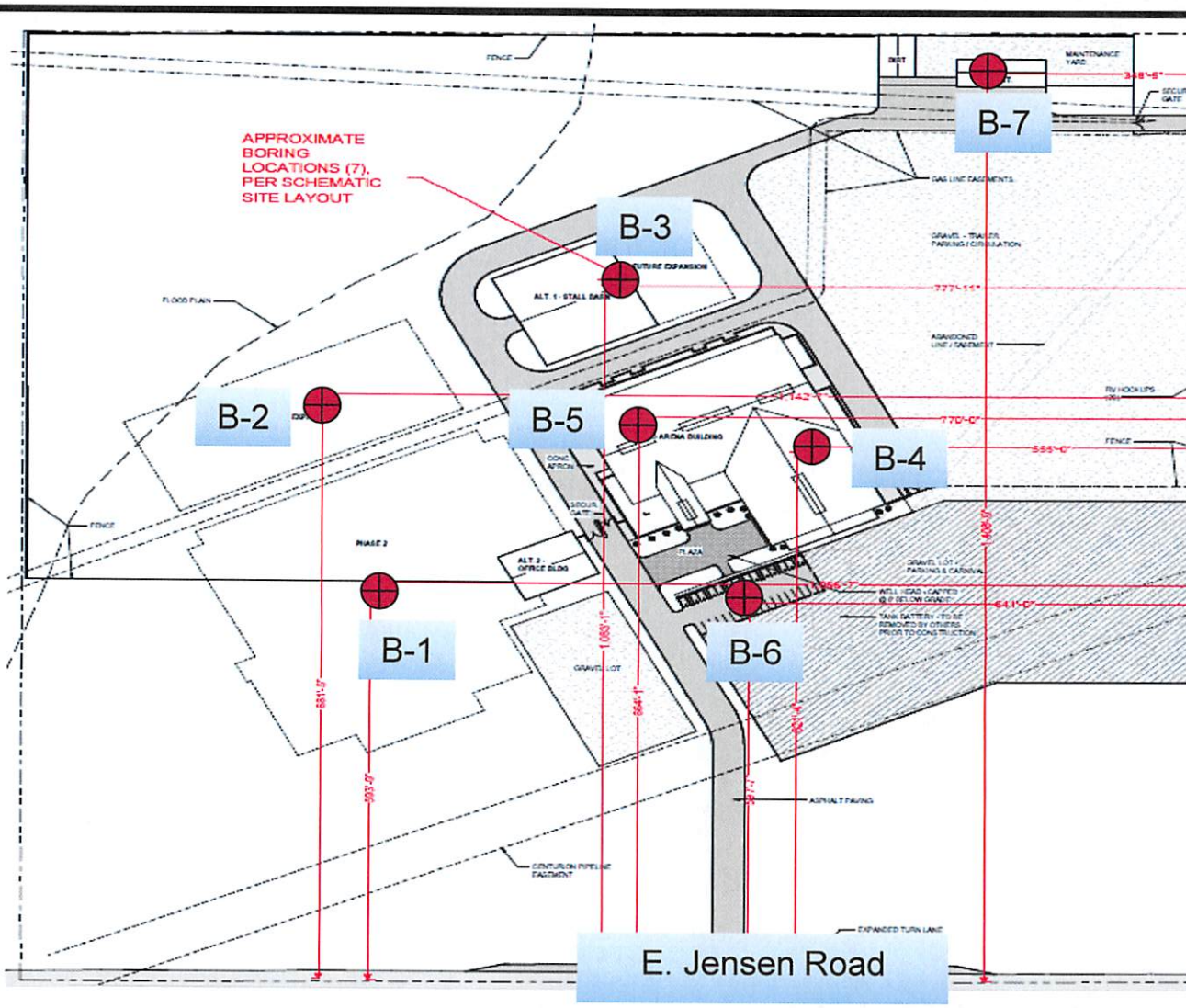

Approximate Boring Location
Not to Scale

N

PLAN OF BORINGS

Proposed Canadian County Fairg
S. Alfadale Road and E. Jen
El Reno, Canadian County, O

METCO JOB#: OGR-19071

METCO

LOG OF BORING B-1

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: 17.0' Depth To Water On: 6/29/2019 Was: 11.8'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		5/6"	3.0" Grass and topsoil							
2		8/6"	Dark brown lean Clay with sand, calcareous	15	40	21	19	85		
3		9/6"	nodules and roots, very stiff (CL)							
4		10/6"		9						
5		14/6"								
		15/6"								
6		9/6"	Reddish brown lean Clay with iron stains, very	10	32	15	17	92		
7		11/6"	stiff to hard (CL)							
		14/6"								
8		14/6"	Reddish brown lean Clay with iron stains and	9						
9		15/6"	calcareous nodules, hard (CL)							
10		16/6"								
11		19/6"	Reddish brown lean Clay with iron stains,	13	36	19	17	94		
12		29/6"	hard (CL)							
13		28/6"								
14										
15										
16		16/6"	Reddish brown lean Clay with calcareous	17						
17		14/6"	inclusions, hard (CL)							
18		21/6"								
19										
20										
21		50/6"	Reddish brown Shale, soft to hard	19						
22										
23										
24										
25		100/1.8"	TC @ 25.0' : 50/1.3", 50/0.5"	28	32	17	15	91		
26										
27										
28										
29										
30										

NOTES:

METCO

FIGURE 2

LOG OF BORING B-2

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: 6/29/2019 Was: 10.3'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		5/6"	3.0" Grass and topsoil Brown lean Clay with iron stains, stiff to very stiff (CL)	13	35	18	17	86		
2		8/6"								
3		8/6"								
4		7/6"	Brown to reddish brown lean Clay with iron stains and calcareous inclusions, very stiff to hard (CL)	12	38	17	21	86		
5		9/6"								
		13/6"								
6		4/6"		10						
7		21/6"								
		23/6"								
8		6/6"	Reddish brown lean Clay with sand, hard (CL)	11	28	15	13	79		
9		16/6"								
10		20/6"								
11		24/6"		14						
		31/6"								
12		26/6"								
13										
14										
15										
		43/6"		13						
16		50/5"	Reddish brown Shale with gray silty layers, soft to hard							
17										
18										
19										
20										
21		100/2.0"	Reddish brown Shale, hard TC @ 20.0' : 50/1.5", 50/0.5"	13	31	16	15	98		
22										
23										
24										
25		100/1.3"	TC @ 25.0' : 50/1.0", 50/0.3"	14						
26										
27										
28										
29										
30										

NOTES:

METCO

FIGURE 3

LOG OF BORING B-3

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: 6/29/2019 Was: 11.6'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		2/6" 4/6" 5/6"	3.0" Grass and topsoil Brown lean Clay with iron stains, stiff to very stiff (CL)	17	34	17	17	86		
4		4/6" 9/6" 11/6"	Reddish brown lean Clay with calcareous inclusions, very stiff (CL)	13	34	15	19	91		
6		8/6" 12/6" 13/6"	Reddish brown lean Clay with sand, iron stains and calcareous inclusions, very stiff to hard (CL)	15						
8		8/6" 11/6" 16/6"		12	27	13	14	83		
11		12/6" 20/6" 24/6"		22						
15		20/6" 50/5"								
16			Reddish brown Shale with gray silty layers, soft to moderately hard	16						
21		100/3.3"	Reddish brown Shale, moderately hard TC @ 20.0' : 50/2.0", 50/1.3"	16						
25		100/2.8"	TC @ 25.0' : 50/1.8", 50/1.0"	14	33	18	15	97		

NOTES:

METCO

FIGURE 4

LOG OF BORING B-4

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: 6/29/2019 Was: 12.8'

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 25.3'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1–3		4/6" 4/6" 4/6"	3.0" Grass and topsoil Dark brown lean Clay with calcareous nodules, firm to stiff (CL)	17	40	19	21	87		
4–5		3/6" 7/6" 5/6"	Reddish brown lean Clay with sand, iron stains and calcareous nodules, stiff (CL)	12	33	15	18	76		
6–7		7/6" 8/6" 7/6"	Brown lean Clay with sand, stiff (CL)	10	30	15	15	78		
8–10		6/6" 5/6" 7/6"		8	29	15	14	75		
11–15		1/6" 6/6" 10/6"	Brown lean Clay with sand and gravel, stiff to very stiff (CL)	14	27	14	13	72		
16–20		7/6" 11/6" 17/6"	Reddish brown lean Clay with calcareous inclusions, very stiff to hard (CL)	17	44	23	21	98		
20–21		25/6"		18						
21–25		50/5"	Reddish brown Shale, soft to moderately hard							
25		100/4.0"	TC @ 25.0' : 50/2.8", 50/1.2"	19						
26–30										

NOTES:

METCO

FIGURE 5

LOG OF BORING B-5

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma | Project No.: OGR-19071

Date Drilled: 6/28/2019 | Location: See Plan of Borings (Figure 1) | Elevation: N/A

Depth To Water At Completion: Dry | Depth To Water On: 6/29/2019 | Was: 14.6'

Drilled By: Kalyn | Logger: Stephen | Approximate Completion Depth: 25.0'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		2/6" 4/6" 9/6"	3.0" Grass and topsoil Dark brown to reddish brown lean Clay with roots, stiff to hard (CL)	20	45	21	24	87		
4		9/6" 17/6" 19/6"	Reddish brown lean Clay with iron stains and calcareous nodules, hard to very stiff (CL)	13	45	19	26	95		
6		11/6" 14/6" 14/6"	Reddish brown lean Clay with iron stains and calcareous nodules, very stiff to hard (CL)	22						
8		11/6" 26/6" 31/6"	Reddish brown lean Clay with iron stains and calcareous nodules, hard to very stiff (CL)	21						
11		15/6" 14/6" 12/6"	Reddish brown lean Clay with gray silty layers, very stiff to hard	16	37	21	16	95		
16		15/6" 29/6" 50/6"	Reddish brown Shale with gray silty layer, soft to moderately hard	17						
21		100/3.5"	Reddish brown Shale, moderately hard to hard TC @ 20.0' : 50/2.3", 50/1.2"	16	38	18	20	95		
25		100/2.3"	TC @ 25.0' : 50/1.8", 50/0.5"	15						
26										
27										
28										
29										
30										

NOTES:

METCO

FIGURE 6

LOG OF BORING B-6

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: End of Day Was: Dry

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 11.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1–3		4/6" 4/6" 5/6"	3.0" Grass and topsoil Dark brown lean Clay, stiff (CL)	21	48	22	26	94		
4–5		3/6" 4/6" 8/6"	Reddish brown lean Clay with calcareous inclusions, stiff (CL)	19	40	16	24	86		
6–7		5/6" 6/6" 7/6"	Reddish brown lean Clay with sand and gravel, stiff to firm (CL)	16	35	16	19	80		
8–10		3/6" 3/6" 4/6"	Reddish brown lean Clay with sand, firm to hard (CL)	18	28	15	13	82		
11		12/6" 13/6" 21/6"	Reddish brown lean Clay with iron stains, hard (CL)	18	35	20	15	95		
12–30										

NOTES:

METCO

FIGURE 7

LOG OF BORING B-7

PROJECT: Proposed Canadian County Fairground Project, El Reno, Canadian County, Oklahoma Project No.: OGR-19071

Date Drilled: 6/28/2019 Location: See Plan of Borings (Figure 1) Elevation: N/A

Depth To Water At Completion: Dry Depth To Water On: End of Day Was: Dry

Drilled By: Kalyn Logger: Stephen Approximate Completion Depth: 11.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		3/6"	4.0" Grass and topsoil							
2		5/6"	Dark brown lean Clay, stiff to very stiff (CL)	18	48	19	29	90		
3		7/6"								
4		7/6"	Brown lean Clay with calcareous inclusions, very stiff (CL)	16						
5		12/6"								
6		13/6"								
7		9/6"	Reddish brown lean Clay with calcareous inclusions and iron stains, very stiff to hard (CL)	14	41	15	26	93		
8		12/6"		14						
9		20/6"								
10		27/6"								
11		10/6"		15	39	20	19	95		
12		16/6"								
13		17/6"								
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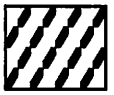
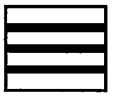
METCO

FIGURE 8

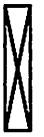
KEY TO SYMBOLS & PATTERNS USED ON BORING LOGS



Lean Clay



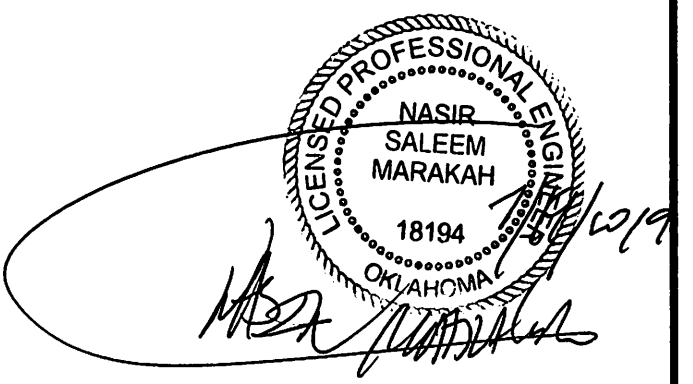
Shale



Standard
Penetration
Test

Bag Sample

Texas Cone Penetrometer
Test



ABBREVIATIONS USED

MC, %	Moisture Content expressed in percentage
LL	Liquid Limit
PI	Plasticity Index
DD, PCF	Dry Density expressed in pounds per cubic feet
-#200, %	Soil Fraction Passing No. 200 Sieve expressed in percentage
swell, %	Free swell under overburden pressure expressed in percentage
PP, TSF	Pocket Penetrometer Reading expressed in tons per square feet

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