PROJECT MANUAL

CAMPUS ADDITIONS AND RENOVATIONS

FOR

GORDON ISD

GORDON, TEXAS

Date: 7.28.2022

HPA
ESTABLISHED 1962
4724 OLD JACKSBORO HIGHWAY
WICHITA FALLS, TEXAS 76302-3599

Architect's Project No. 20864.00
Date: July 28, 2022


HPA
ESTABLISHED 1962

SECTION 000101 - PROJECT TITLE PAGE

PROJECT MANUAL

FOR

GORDON ISD CAMPUS ADDITIONS AND RENOVATIONS

ARCHITECT'S PROJECT NUMBER: 20864.00

GORDON ISD

112 RUSK

GORDON, TEXAS 76453

BOARD OF TRUSTEES
KATHY CULBERTSON, PRESIDENT
STACEY WYATT, VICE PRESIDENT
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BRETT CLARK
LAURA JONES
SARAH KNIGHT
BRETT TRIGG

HOLLY CAMPBELL, SUPERINTENDENT

DATE: 07/28/2022

PREPARED BY:

HPA
ESTABLISHED 1962

END OF SECTION 000101

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SECTION 000102 - PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: Gordon ISD Campus Additions and Renovations

B. Architect's Project Number: 20864.00.

C. Located at:
112 Rusk, Gordon, Texas 76453

D. The Owner, hereinafter referred to as Owner: Gordon ISD

E. Owner's Representative: Holly Campbell, Superintendent .
112 Rusk
Gordon TX 76453
Phone: 254-693-5342.
E-mail: hcampbell@gordonhorns.net.

1.02 NOTICE TO PROSPECTIVE BIDDERS

A. These documents constitute an Invitation to Bid to Subcontractors for the construction of the project described below.

1.03 PROJECT DESCRIPTION

A. Summary Project Description:

B. Contract Scope: Construction. New High School building - full turnkey construction from site, site utilities to complete facility including all finish out, and renovation of existing Elementary School Building, and renovations to the existing Ag classroom building.

C. Contract Terms: CMaR - Cost plus a fee.

1.04 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Architect: HPA.
4724 Old Jacksboro Highway
Wichita Falls, TX 76302
Phone: 940-767-1421
Project Architect and Manager: CW Farris
E-mail: CW@HPA1962.com

1.05 PROCUREMENT TIMETABLE

A. Pre-Bid Briefing and Site Tour: August 12, 2022 at 9:30 AM at Owner's address.

B. Requests for Information should be directed to CMaR and/or Architect (see Section 000103 - Project Directory).
Pete Durant & Associates
Darrell Durant

2040 Golden Triangle Dr., Fort Worth TX 76177
Phone: 817-439-3213
Email: darrell@petedurant.com

C. Bid Due Date: 08/23/2022 before 3:00 PM local time.

D. Bid Opening: Same day.

E. Notice to Proceed: Will be as quickly as possible, as bids will be considered at next board meeting for approval and authorization.

F. Bids May Not Be Withdrawn Until: 60 days after due date.

G. Contract Time: To be stated in bid documents, and set forth by the CM@R.

H. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.06 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
1. From Architect at the Architect's address listed above.
2. From Contractor at the Contractor's address listed above.

B. Documents may be viewed:
1. Digitally by contacting CW Farris at 940-767-1421; CW@HPA1962.com
2. At the Architect's office at the address listed above

C. Documents are available at the following construction plan rooms:
1. West Texas AGC Plan Room.
2. DFW Planroom - www.dfwplanroom.com.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 000102

SECTION 000103 - PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 OWNER:

A. Name: Gordon ISD
112 Rusk
Gordon TX 76453
Telephone: 254-693-5342.

B. Primary Contact: All correspondence from the CMaR to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
Title: Project Architect & Project Manager.
Name: C.W. Farris.
Email: CW@HPA1962.com

1.03 CONSULTANTS:

A. Architect: Design Professional of Record. All correspondence from the CMaR regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon prior to contact.
1. Company Name: HPA.
4724 Old Jacksboro Highway
Wichita Falls, TX 76302
Telephone: 940-766-1421.
2. Primary Contact:
Title: Project Manager.
Name: C.W. Farris.
Email: CW@HPA1962.com

1.04 CONSTRUCTION MANAGER AT RISK:

A. Company Name: Pete Durant & Associates.
2040 Golden Triangle Dr.
Fort Worth TX 76177
Telephone: 817-439-3213.

B. Primary Contact:
Title: President.
Name: Darrell Durant.
Email: darrell@petedurant.com

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 000103

SECTION 000110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

SPECIFICATIONS

Division 32 -- Exterior Improvements - Reference Civil and Landscape Drawings

Division 33 -- Utilities - Reference Civil Drawings

END OF SECTION

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SECTION 000115 - LIST OF DRAWING SHEETS

NUMBER	TITLE	DATE
C101	LOCATION MAP, LEGEND, NOTES & INDEX	28 JULY 2022
C102	EXISTING SITE PLAN	28 JULY 2022
C103	DEMOLITION PLAN	28 JULY 2022
C104	SITE GRADING PLAN	28 JULY 2022
C104A	ALTERNATE SITE GRADING PLAN & AGRICULTURAL BLDG.	28 JULY 2022
C105	DIMENSION CONTROL PLAN	28 JULY 2022
C106	UTILITY PLANS	28 JULY 2022
C107	UTILITY DETAILS	28 JULY 2022
C108	UTILITY & SITEWORK DETAILS	28 JULY 2022
C109	PAVING DETAILS	28 JULY 2022
C110	DRAINAGE DETAILS	28 JULY 2022
C111	SWPPP PLAN	28 JULY 2022
S101	STRUCTURAL NOTES	28 JULY 2022
S102	STRUCTURAL SCHEDULES & DETAILS	28 JULY 2022
S201	FOUNDATION PLAN – SECONDARY	28 JULY 2022
S202	MEZZANINE FRAMING PLAN – SECONDARY	28 JULY 2022
S203	ROOF FRAMING PLAN – SECONDARY	28 JULY 2022
S204	FOUNDATION PLAN – ELEMENTARY	28 JULY 2022
S205	ROOF FRAMING PLAN – ELEMENTARY	28 JULY 2022
S301	STRUCTURAL DETAILS	28 JULY 2022
S302	STRUCTURAL DETAILS	28 JULY 2022
S303	STRUCTURAL DETAILS	28 JULY 2022
S401	STRUCTURAL DETAILS	28 JULY 2022
AD101	FLOOR PLAN – DEMOLITION	28 JULY 2022
A100	FLOOR PLAN – FULL	28 JULY 2022
A101	FLOOR PLAN – SECONDARY – NOTED	28 JULY 2022
A102	FLOOR PLAN – SECONDARY – DIMENSIONED AND MEZZANINE	28 JULY 2022
A103	FLOOR PLAN – ELEMENTARY – NOTED	28 JULY 2022
A104	FLOOR PLAN – ELEMENTARY – DIMENSIONED	28 JULY 2022
A105	FLOOR PLAN - CTE – DEMOLITION, NEW PLAN AND REFLECTED CEILING	28 JULY 2022
A201	EXTERIOR ELEVATIONS	28 JULY 2022
A202	EXTERIOR ELEVATION AND DETAILS	28 JULY 2022
A203	BUILDING SECTIONS - SECONDARY - FOR REFERENCE	
A301	EXTERIOR WALL SECTIONS	28 JULY 2022
A302	EXTERIOR WALL SECTION & DETAILS	28 JULY 2022
A303	WALL SECTIONS	28 JULY 2022
A304	WALL SECTIONS	28 JULY 2022
A305	WALL SECTIONS	28 JULY 2022

A306	WALL SECTIONS	28 JULY 2022
A307	WALL SECTIONS	28 JULY 2022
A308	WALL SECTIONS	
A401	INTERIOR ELEVATIONS	28 JULY 2022
A402	INTERIOR ELEVATIONS	28 JULY 2022
A403	INTERIOR ELEVATION SECTIONS & DETAILS	28 JULY 2022
A404	INTERIOR ELEVATIONS AND MISCELLANEOUS DETAILS	28 JULY 2022
A501	OPENING TYPES, SCHEDULE, AND DETAILS	28 JULY 2022
A502	OPENING DETAILS	28 JULY 2022
A503	OPENING DETAILS	28 JULY 2022
A701	REFLECTIVE CEILING PLAN – ELEMENTARY AND DETAILS	28 JULY 2022
A702	REFELCTIVE CEILING PLAN – SECONDARY	28 JULY 2022
A703	REFLECTIVE CEILING DETAILS	28 JULY 2022
A704	ROOF PLAN – DEMOLITION	28 JULY 2022
A705	ROOF PLAN – SECONDARY AND DETAILS	28 JULY 2022
A706	ROOF PLAN – ELEMENTARY AND DETAILS	28 JULY 2022
QF101	FOOD SERVICE EQUIPMENT PLAN AND SCHEDULE	28 JULY 2022
QL101	SCIENCE EQUIPMENT PLAN AND SCHEDULE	28 JULY 2022
MD101	FLOOR PLANS – MECHANICAL DEMOLITION	28 JULY 2022
M101	FLOOR PLANS – ELEMENTARY – MECHANICAL	28 JULY 2022
M102	FLOOR PLANS – SECONDARY – MECHANICAL	28 JULY 2022
M201	FLOOR PLAN – ELEMENTARY – MECHANICAL PIPING	28 JULY 2022
M202	FLOOR PLANS – SECONDARY – MECHANICAL PIPING	28 JULY 2022
M301	FLOOR PLANS – AG (CTE) – MECHANICAL	28 JULY 2022
M401	MECHANICAL SCHEDULES	28 JULY 2022
M402	MECHANICAL VRV PIPING - WIRING DIAGRAMS	
M403	MECHANICAL VRV PIPING - WIRING DIAGRAMS	
M404	KITCHEN VENTILATION SYSEM SCHEDULES AND DETAILS	
M405	MECHANICAL DETAILS	
M406	MECHANICAL DETAILS	
PD101	FLOOR PLANS – PLUMBING – NORTH/SOUTH DEMOLITION	28 JULY 2022
P101	FLOOR PLANS – ELEMENTARY PLUMBING – SEWER, WASTE, AND VENT	28 JULY 2022
P102	FLOOR PLANS – SECONDARY PLUMBING – SEWER, WASTE AND VENT	28 JULY 2022
P201	FLOOR PLAN – ELEMENTARY PLUMBING DOMESTIC WATER AND GAS	28 JULY 2022
P202	FLOOR PLAN – SECONDARY PLUMBING DOMESTIC WATER AND GAS	28 JULY 2022
P301	FLOOR PLAN – AG (CTE) DEMOLITION AND PLUMBING	28 JULY 2022
P401	PLUMBING RISER DIAGRAM AND NOTES	28 JULY 2022
P501	PLUMBING FIXTURE & SCHEDULES	28 JULY 2022
P502	PLUMBING DETAILS & SCHEDULES	28 JULY 2022
P503	PLUMBING DETAILS & SCHEDULES	28 JULY 2022
FP101	FLOOR PLAN – FIRE SPRINKLER SYSTEM	28 JULY 2022

ES101	SITE PLAN – ELECTRICAL DEMOLITION	28 JULY 2022
ES102	SITE PLAN – ELECTRICAL	28 JULY 2022
ED101	FLOOR PLAN – ELECTRICAL DEMOLITION – NORTH/SOUTH	28 JULY 2022
E101	FLOOR PLAN – ELEMENTARY – LIGHTING	28 JULY 2022
E102	FLOOR PLAN – SECONDARY – LIGHTING	28 JULY 2022
E201	FLOOR PLAN – ELEMENTARY – POWER/COMMUNICATIONS	28 JULY 2022
E202	FLOOR PLAN – SECONDARY/MEZZANINE – POWER/COMMUNICATIONS	28 JULY 2022
E301	FLOOR PLAN – ELEMENTARY – MECHANICAL POWER	28 JULY 2022
E302	FLOOR PLAN – SECONDARY – MECHANICAL POWER	28 JULY 2022
E401	FLOOR PLAN – AG (CTE) DEMOLITION AND ELECTRICAL	28 JULY 2022
E501	ELECTRICAL LIGHTING DETAILS	28 JULY 2022
E601	ELECTRICAL RISER DIAGRAM – AG BUILDING	28 JULY 2022
E602	ELECTRICAL PANEL SCHEDULES	28 JULY 2022
E603	ELECTRICAL PANEL BOARDS SCHEDULES	28 JULY 2022
E701	ELECTRICAL LEGEND AND LIGHT FIXTURE SCHEDULE	28 JULY 2022

END OF SECTION 000115

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SECTION 001113 - ADVERTISEMENT FOR BIDS

FROM:

1.01 THE Owner (HEREINAFTER REFERRED TO AS Owner): Gordon ISD

Address: 112 Rusk, Gordon TX 76453

1.02 AND THE Architect (HEREINAFTER REFERRED TO AS Architect): HPA

Address: 4724 Old Jacksboro Highway, Wichita Falls, TX 76302

1.03 DATE: 07/28/2022

1.04 TO: SUB-CONTRACTORS & MATERIAL SUPPLIERS

1.05 TO: POTENTIAL BIDDERS

Your firm is invited to submit an offer to CMaR in care of the Owner for the Project described below located at:
112 Rusk
Gordon, Texas 76453

Before 3:00 pm local standard time on 08/23/2022, for:

Project: Gordon ISD Campus Additions and Renovations

Architect's Project Number: 20864.00

Project Description: This project is a new construction of a Secondary (High School) building attached to the existing building on the school campus. The project will include full site utilities, through complete finish out for a turnkey new facility. The pre-engineered metal building will be completed east of the existing building. The elementary school building to the east of the existing facility will be demolished in order to allow for construction of the new high school. Both buildings will contain masonry, concrete, drywall walls, full MEP, and finishes, science and kitchen equipment and accessories. Renovations at the existing Ag classroom building will include electrical upgrades, plumbing modifications, new windows, drywall, paint and ceilings modifying toilet and providing handicap parking.

Bid Documents may be obtained as a hard copy or in electronic form from the office of the HPA or PDA free of charge.

Submit your offer on the Bid Form provided.

Your offer will be required to be submitted under a condition of irrevocability for a period of 60 days after submission.

The Owner reserves the right to accept or reject any or all offers.

END OF SECTION 001113

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SECTION 002113 - INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 SEE AIA A701, INSTRUCTIONS TO BIDDERS bound in the Project Manual.

END OF SECTION 002113

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AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:

Gordon ISD Campus Additions and Renovations – Project 20864.00
112 Rusk Street
Gordon, TX 76453

THE OWNER:

Gordon ISD
112 Rusk Street
Gordon, TX 76453

THE ARCHITECT:

Harper Perkins Architects, Inc. (HPA)
4724 Old Jacksboro Hwy
Wichita Falls, Texas 76302

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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 any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

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

§ 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, to which Work may be added or deleted by 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, or that does not change, 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 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** 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 observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum stated therein.

(Paragraph deleted)

For electronic documents, contact HPA Architect, C.W. Farris, 940-767-1421, cw@hpa1962.com, or Pete Durant Associates, CMaR, 817-439-3213, darrell@petedurant.com.

A paper copy set of Drawings, Specifications, and other Contract Documents may be examined, without charge, at the offices of HPA; the office of Pete Durant and Associates located at 2040 Golden Triangle Drive, Fort Worth, TX 76177;

the Wichita Falls AGC Plan Room located at 2014 Kell W. Blvd., Ste C, Wichita Falls, TX 76301 or may be obtained by Contractors from the offices of HPA.

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 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.

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

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

Contact C. W. Farris, HPA Architect, cw@hpa1962.com, 940-767-1421

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall 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 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

(Paragraph deleted)

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications, that will result from incorporation of the proposed substitution.

§ 3.3.3 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.

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

(Paragraph deleted)

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Paragraph deleted)

Electronic format or paper copy will be transmitted by HPA. Contact C.W. Farris, HPA Architect, cw@hpa1962.com, 940-767-1421

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms 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" or as required by the bid form.

§ 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 neither make 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 and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name 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.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

Provide Bid Bond on standard insurance carrier provided documents.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, 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. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning 60 days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

All bids should be submitted via email in electronic format to Darrell Durant at darrell@petedurant.com

§ 4.3.2 Paper copies of the Bid, the bid security, 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.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

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

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect or CM@R of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be
(Paragraphs deleted)
returned once GMP is set and approval by the Owner.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law,

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 best interests.

§ 5.3.2 Unless otherwise prohibited by law, 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 lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

(Paragraphs deleted)

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; 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 Architect will notify the Bidder if either the Owner or Architect, 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, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for 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 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.

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.

§ 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 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

(Paragraphs deleted)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner 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.

§ 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 to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A133™–2019, Standard Form of Agreement Between Owner and
(Paragraphs deleted)
Contractor with A133 – 2019 Exhibit A GMP Amendment.

(Paragraphs deleted)

.2 AIA Document A133™–2019, Exhibit B, Insurance and Bonds.

.3 AIA Document A201™–2017, General Conditions of the Contract for
(Paragraphs deleted)
Construction.

.5 Drawings

Number	Title	Date
CIVIL		
C101	LOCATION MAP, LEGEND, NOTES & INDEX	28 JULY 2022
C102	EXISTING SITE PLAN	28 JULY 2022
C103	DEMOLITION PLAN	28 JULY 2022
C104	SITE GRADING PLAN	28 JULY 2022
C104A	ALTERNATE SITE GRADING PLAN & AGRICULTURAL BLDG.	28 JULY 2022
C105	DIMENSION CONTROL PLAN	28 JULY 2022
C106	UTILITY PLANS	28 JULY 2022
C107	UTILITY DETAILS	28 JULY 2022
C108	UTILITY & SITEWORK DETAILS	28 JULY 2022
C109	PAVING DETAILS	28 JULY 2022
C110	DRAINAGE DETAILS	28 JULY 2022
C111	SWPPP PLAN	28 JULY 2022
STRUCTURAL		
S101	STRUCTURAL NOTES	28 JULY 2022
S102	STRUCTURAL SCHEDULES & DETAILS	28 JULY 2022
S201	FOUNDATION PLAN – SECONDARY	28 JULY 2022
S202	MEZZANINE FRAMING PLAN – SECONDARY	28 JULY 2022
S203	ROOF FRAMING PLAN – SECONDARY	28 JULY 2022
S204	FOUNDATION PLAN – ELEMENTARY	28 JULY 2022
S205	ROOF FRAMING PLAN – ELEMENTARY	28 JULY 2022
S301	STRUCTURAL DETAILS	28 JULY 2022
S302	STRUCTURAL DETAILS	28 JULY 2022
S303	STRUCTURAL DETAILS	28 JULY 2022
S401	STRUCTURAL DETAILS	28 JULY 2022
S402	STRUCTURAL DETAILS	

ARCHITECTURAL

AD101	FLOOR PLAN – DEMOLITION	28 JULY 2022
A100	FLOOR PLAN – FULL	28 JULY 2022
A101	FLOOR PLAN – SECONDARY – NOTED	28 JULY 2022
A102	FLOOR PLAN – SECONDARY – DIMENSIONED AND MEZZANINE	28 JULY 2022
A103	FLOOR PLAN – ELEMENTARY – NOTED	28 JULY 2022
A104	FLOOR PLAN – ELEMENTARY – DIMENSIONED	28 JULY 2022
A105	FLOOR PLAN - CTE – DEMOLITION, NEW PLAN AND REFLECTED CEILING	28 JULY 2022
A201	EXTERIOR ELEVATIONS	28 JULY 2022
A202	EXTERIOR ELEVATION AND DETAILS	28 JULY 2022
A203	BUILDING SECTIONS – SECONDARY – FOR REFERENCE	
A301	EXTERIOR WALL SECTIONS	28 JULY 2022
A302	EXTERIOR WALL SECTIONS & DETAILS	28 JULY 2022
A303	WALL SECTIONS	28 JULY 2022
A304	WALL SECTIONS	28 JULY 2022
A305	WALL SECTIONS	28 JULY 2022
A306	WALL SECTIONS	28 JULY 2022
A307	WALL SECTIONS	28 JULY 2022
A308	WALL SECTIONS	
A401	INTERIOR ELEVATIONS	28 JULY 2022
A402	INTERIOR ELEVATIONS	28 JULY 2022
A403	INTERIOR ELEVATION SECTIONS & DETAILS	28 JULY 2022
A404	INTERIOR ELEVATIONS AND MISCELLANEOUS DETAILS	28 JULY 2022
A501	OPENING TYPES, SCHEDULE, AND DETAILS	28 JULY 2022
A502	OPENING DETAILS	28 JULY 2022
A503	OPENING DETAILS	28 JULY 2022
A701	REFLECTIVE CEILING PLAN – ELEMENTARY AND DETAILS	28 JULY 2022
A702	REFELCTIVE CEILING PLAN – SECONDARY	28 JULY 2022
A703	REFLECTIVE CEILING DETAILS	28 JULY 2022
A704	ROOF PLAN – DEMOLITION	28 JULY 2022
A705	ROOF PLAN – SECONDARY AND DETAILS	28 JULY 2022
A706	ROOF PLAN – ELEMENTARY AND DETAILS	28 JULY 2022
QF101	FOOD SERVICE EQUIPMENT PLAN AND SCHEDULE	28 JULY 2022
QL101	SCIENCE EQUIPMENT PLAN AND SCHEDULE	28 JULY 2022

MECHANICAL

MD101	FLOOR PLANS – MECHANICAL DEMOLITION	28 JULY 2022
M101	FLOOR PLANS – ELEMENTARY – MECHANICAL	28 JULY 2022
M102	FLOOR PLANS – SECONDARY – MECHANICAL	28 JULY 2022
M201	FLOOR PLAN – ELEMENTARY – MECHANICAL PIPING	28 JULY 2022
M202	FLOOR PLANS – SECONDARY – MECHANICAL PIPING	28 JULY 2022
M301	FLOOR PLANS – AG (CTE) – MECHANICAL	28 JULY 2022
M401	MECHANICAL SCHEDULE	28 JULY 2022
M402	MECHANICAL VRV PIPING – WIRING DIAGRAMS	
M403	MECHANICAL VRV PIPEING – WIRING DIAGRAMS	
M404	KITCHEN VENTILATION SYSTEM SCHEDULES AND DETAILS	
M405	MECHANICAL DETAILS	
M406	MECHANICAL DETAILS	

PLUMBING

PD101	FLOOR PLANS – PLUMBING – NORTH/SOUTH DEMOLITION	28 JULY 2022
P101	FLOOR PLANS – ELEMENTARY PLUMBING – SEWER, WASTE, AND VENT	28 JULY 2022
P102	FLOOR PLANS – SECONDARY PLUMBING – SEWER, WASTE	28 JULY 2022

	AND VENT	
P201	FLOOR PLAN – ELEMENTARY PLUMBING DOMESTIC WATER AND GAS	28 JULY 2022
P202	FLOOR PLAN – SECONDARY PLUMBING DOMESTIC WATER AND GAS	28 JULY 2022
P301	FLOOR PLAN – AG (CTE) DEMOLITION AND PLUMBING	28 JULY 2022
P401	PLUMBING RISER DIAGRAM AND NOTES	28 JULY 2022
P501	PLUMBING FIXTURE & SCHEDULES	28 JULY 2022
P502	PLUMBING DETAILS & SCHEDULES	28 JULY 2022
P503	PLUMBING DETAILS & SCHEDULES	28 JULY 2022
P504	PLUMBING DETAILS	
FP101	FLOOR PLAN – FIRE SPRINKLER SYSTEM	28 JULY 2022
ELECTRICAL		
ES101	SITE PLAN – ELECTRICAL DEMOLITION	28 JULY 2022
ES102	SITE PLAN – ELECTRICAL	28 JULY 2022
ED101	FLOOR PLAN – ELECTRICAL DEMOLITION – NORTH/SOUTH	28 JULY 2022
E101	FLOOR PLAN – ELEMENTARY – LIGHTING	28 JULY 2022
E102	FLOOR PLAN – SECONDARY – LIGHTING	28 JULY 2022
E201	FLOOR PLAN – ELEMENTARY – POWER/COMMUNICATIONS	28 JULY 2022
E202	FLOOR PLAN – SECONDARY/MEZZANINE – POWER/COMMUNICATIONS	28 JULY 2022
E301	FLOOR PLAN – ELEMENTARY – MECHANICAL POWER	28 JULY 2022
E302	FLOOR PLAN – SECONDARY – MECHANICAL POWER	28 JULY 2022
E401	FLOOR PLAN – AG (CTE) DEMOLITION AND ELECTRICAL	28 JULY 2022
E501	ELECTRICAL LIGHTING DETAILS	28 JULY 2022
E601	ELECTRICAL RISER DIAGRAM – AG BUILDING	28 JULY 2022
E602	ELECTRICAL PANEL SCHEDULES	28 JULY 2022
E603	ELECTRICAL PANEL BOARDS SCHEDULES	28 JULY 2022
E701	ELECTRICAL LEGEND AND LIGHT FIXTURE SCHEDULE	28 JULY 2022

.6 Specifications – See Attached Table of Contents

(Paragraphs deleted)

.7 Addenda, as required

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SECTION 003100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Very little information relating to existing surface and subsurface conditions is available to bidders and is a part of Contract Documents.

B. Site and Utility Survey: Entitled Topographic Survey as provided in construction documents.
   1. Original survey is available for inspection at Architect's office during normal business hours.
   2. Copy is included in the Construction Documents.

C. Geotechnical Report: Entitled Gordon ISD Addition Geotechnical Investigation, dated March 18, 2022, prepared by D&S Engineering; Report #G21-2350.
   1. Original copy is included herein.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 OBTAINMENT OF PERMITS

A. CMaR to obtain the following required permits as part of the GMP:
   1. Building Permit for all trades.

B. Building Permit Procedures: When required to obtain this permit:
   1. Complete and file permit application(s) with appropriate agency.
      a. Submit application as soon as possible after date of execution of the Contract.
   2. Pay required fees.
   3. Do not commence execution of any item of work for which a permit has not been obtained.

END OF SECTION 003100

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Geotechnical Engineering Report

Gordon ISD Addition

Gordon, Texas

March 18, 2022

D&S ENGINEERING LABS

D&S ENGINEERING LABS

March 18, 2022

Holly Campbell, Supt. Of Schools
Gordon Independent School District
c/o Harper Perkins Architects
4724 Old Jacksboro Highway
Wichita Falls, Texas 76302

GEOTECHNICAL INVESTIGATION
D&S ENGINEERING #G21-2350
GORDON ISD SECONDARY FACILITY
GORDON, TEXAS

Ms. Campbell,

As requested, D&S Engineering Labs, LLC has completed the Geotechnical Investigation for the above referenced project. This investigation was conducted in accordance with Proposal No. GP21-2350 dated December 16, 2021. Authorization to proceed was received on January 31, 2022.

We appreciate the opportunity to provide professional geotechnical engineering services to you. We are available to discuss any questions which may arise regarding this report. Please do not hesitate to call when we can provide any additional services.

Sincerely,

D&S Engineering Labs, LLC

3-18-2022

STATE OF TEXAS
IBRAHIM A. BAAYEH
132175
LICENSED
PROFESSIONAL ENGINEER

Douglas Greenwood, P.E.
Senior Geotechnical Engineer

Ibrahim A. Baayeh, P.E.
Director of Geotechnical Engineering

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION
GORDON ISD SECONDARY FACILITY
GORDON, TEXAS

1.0 PROJECT DESCRIPTION

This report presents the results of the geotechnical investigation conducted for proposed additions to the Gordon ISD campus located at 112 Rusk in Gordon, Texas. The proposed additions are to consist of a new approximate 25,000 square foot pre-engineered metal building (PEMB) and associated parking areas.

The proposed metal building location is currently covered by short grass and adjacent to the existing school building. Based on site observations and available USGS topographic maps (www.ngmdb.gov) grade changes within the building footprint are on the order of 1 foot. Grading plans were not available at the time of this report preparation; therefore, we anticipate that finished grades will be at or near existing grades. Below are photographs of recent site conditions:

2.0 PURPOSE AND SCOPE

The purpose of this investigation was to:

- Identify the subsurface stratigraphy and groundwater conditions present at the project site.
- Evaluate the physical and engineering properties of the subsurface soil and bedrock strata for use in the geotechnical analyses.
- Provide geotechnical recommendations for use in the design and construction of foundations for the proposed new additions.

The scope of this investigation consisted of:

- Drilling and sampling of four (4) borings across the site. All borings were drilled within the proposed building footprint to depths of about 25 feet.

- Laboratory testing of selected soil and bedrock samples obtained during the field investigation.

- Preparation of a Geotechnical Report that includes the following:

    - Evaluation of Potential Vertical Movement (PVM).
    - Recommendations for the design and construction of foundations.
    - Recommendations for the design and construction of site pavements and pavement subgrade stabilization.
    - Recommendations for earthwork.

3.0 FIELD AND LABORATORY INVESTIGATION

3.1 General

The borings were advanced utilizing truck-mounted drilling equipment outfitted with continuous hollow stem augers. Undisturbed samples of cohesive soils and weathered bedrock strata were obtained using 3-inch diameter tube samplers, which were advanced into the soils in 1 to 2-foot increments by a continuous thrust of a hydraulic ram located on the drilling equipment. After sample extrusion, a hand penetrometer measurement was performed on each cohesive soil sample to provide an estimate of soil stiffness.

Soil and bedrock materials were intermittently tested in-situ using cone penetration tests in order to determine their resistance to penetration. For this test, a 3-inch diameter steel cone is driven by the energy of a 170-pound hammer falling freely from a height of 24 inches and striking an anvil located at the top of the drill string. Depending on the resistance of the soil and bedrock materials, either the number of blows of the hammer required to provide 12 inches of penetration is recorded (as two increments of 6 inches each), or the inches of penetration of the cone resulting from 100 blows of the hammer are recorded (as two increments of 50 blows each).

All samples obtained were extruded in the field, placed in plastic bags to minimize changes in the natural moisture condition, labeled according to the appropriate boring number and depth, and placed in protective cardboard boxes for transportation to the laboratory. The approximate locations of the borings performed at the site are shown on the boring location plan that is included in Appendix A. The specific depths, thicknesses and descriptions of the strata encountered are presented on the individual Boring Log illustrations, which are also included in Appendix A. The approximate surface elevations shown on the boring logs were estimated from the USGS topographic map website (www.ngmdb.gov), which provides spot elevations as well as topographic maps with 10-foot elevation intervals. Strata boundaries shown on the boring logs are approximate.

3.2 Laboratory Testing

Laboratory tests were performed to identify the relevant engineering characteristics of the subsurface materials encountered and to provide data for developing engineering design parameters. The subsurface materials recovered during the field exploration were initially logged by the drill crew, then were described by a Geotechnical Engineer in the laboratory. These descriptions were later refined by a Geotechnical Engineer based on results of the laboratory tests performed. All recovered soil samples were classified and described in part using the Unified Soil Classification System (USCS) and other accepted procedures. Bedrock strata were described using standard geologic nomenclature.

In order to determine soil characteristics and to aid in classifying the soils, index property and classification testing was performed on selected soil samples as requested by the Geotechnical Engineer. These index property and classification tests were performed in general accordance with the following ASTM testing standards:

- Moisture Content ASTM D2216
- Atterberg Limits ASTM D4318
- Percent of Particles Finer than No 200 Sieve ASTM D1140

Additional tests were performed to aid in evaluating volume change and strength characteristics which consisted of the following:

- Overburden Swell Testing
- Unconfined Compressive Strength of Soil Samples ASTM D2166

The results of these tests are presented at the corresponding sample depths on the appropriate Boring Log illustrations. The index property and classification testing procedures are described in more detail in Appendix B.

3.2.1 Overburden Swell Tests

Selected samples of the near-surface soils were subjected to overburden swell testing. For this test, a sample is placed in a consolidometer and subjected to the estimated overburden pressure. The sample is then inundated with water and is allowed to swell. The moisture content of the sample is determined both before and after completion of the test. Test results are recorded, including the percent swell and the initial and final moisture contents.

3.2.2 Unconfined Compression Tests

Unconfined compression strength testing was performed on selected samples of the cohesive soils and weathered shale bedrock. These tests were performed in general accordance with ASTM D2166. During each test, a

cylindrical specimen is subjected to an axial load that is applied at a constant rate of strain until either failure or a large strain (i.e., greater than 15 percent) occurs. Once the test is completed, the unit weight of the sample is determined based on the moisture content.

4.0 SITE CONDITIONS

4.1 Stratigraphy

Based upon a review of the recovered samples, as well as the Geologic Atlas of Texas, Abilene Sheet, this site is characterized by soil and bedrock strata associated with the Mingus Formation. This formation generally consists of residual clay and sand soils overlying shale, sandstone, and/or limestone bedrock strata.

At the ground surface within Borings B2 and B4, clayey sand soils are present. The clayey sand soils are medium dense in condition, various shades of brown and orange in color, are fine grained, and contain varying amounts of ferrous nodules. The clayey sand soils extend to depths of about 3 to 5 feet.

Beneath the clayey sand soils and at the ground surface of Borings B1 and B3, sandy lean clay soils were encountered. The sandy lean clay soils present are stiff to very stiff in consistency, various shades of brown and orange in color, and contain varying amounts of ferrous nodules, calcareous deposits, iron oxide stains, sandstone fragments, limestone fragments, and occasional shale seams and sand laminations. The clay soils extend to the top of weathered shale bedrock at depths of about 10 feet.

The weathered shale bedrock strata encountered beneath the overburden soils are very soft to medium hard in rock hardness, various shades of brown, orange, and gray in color, and contain varying amounts of sand, sandstone fragments, interbedded limestone, gravel, and iron oxide stains. The weathered shale bedrock extends to depths of about 20 to 21 feet.

Fresh shale bedrock was encountered beneath the weathered shale bedrock strata. The fresh shale bedrock strata are very soft to medium hard in rock hardness and various shades of gray in color. The fresh shale bedrock extends to the maximum depths explored of about 25 feet.

4.2 Groundwater

Groundwater seepage was encountered within Borings B1, B3, and B4 at depths of 13 feet during drilling activities, and at depths ranging from 12 to 17 feet upon completion of drilling operations. Boring B2 was observed to be dry during and after completion of drilling activities. Groundwater levels may be anticipated to fluctuate with seasonal and annual variations in rainfall, and also may vary as a result of development and landscape irrigation. Groundwater is often contained within the

joints, fractures and other rock mass defects present in bedrock strata. When intercepted, these defects can produce appreciable amounts of water for a period of time, especially if those defects are extensive and well inter-connected.

5.0 ENGINEERING ANALYSIS

5.1 Estimated Potential Vertical Movement (PVM)

Potential Vertical Movement (PVM) was evaluated utilizing different methods for predicting movement, as described in Appendix B, and based on our experience and professional opinion.

At the time of our field investigation, the overburden soils were generally found to be dry to wet in moisture condition. Based upon the results of our analysis, the site is estimated to possess a PVM on the order of 1.5 inches at the soil moisture conditions existing at the time of the field investigation. If the near surface soils are allowed to dry appreciably to significant depth prior to or during construction, the potential for post-construction vertical movement may increase. Please note that dry, average and wet are relative terms based on moisture content and plasticity.

6.0 FOUNDATION RECOMMENDATIONS

The near-surface soils present at the site have some low potential for post-construction vertical movement with changes in soil moisture content. If potential movements on the order of 1-inch cannot be tolerated for the proposed building, we recommend using a straight-sided drilled shaft foundation system founded in the weathered shale bedrock with a structurally supported grade beam and suspended floor slab to provide the least risk of post-construction vertical movements. However, if potential movements of 1-inch can be tolerated, a soil-supported floor slab may be utilized in conjunction with either straight sided drilled shafts or shallow footings if the subgrade soils are prepared as recommended in the earthwork recommendations section of this report.

Please note that a shallow foundation and soil-supported floor system may experience some vertical movement with changes in soil moisture content. Non-load bearing walls, partitions, and other elements bearing on the floor slab will reflect these movements should they occur. However, with appropriate design, adherence to good construction practices and appropriate post-construction maintenance, these potential movements can be reduced. The majority of the movement is expected to occur within 10 feet of the perimeter of the building, and any walls bearing on the slab in the areas of movement may exhibit distress.

6.1 Straight-sided Drilled Shafts

The new additions may be supported on auger-excavated, straight-sided, reinforced concrete drilled shafts founded in the weathered shale bedrock, encountered at depths of about 10 feet below existing grades. We recommend that straight-sided

drilled piers for structural loads be a minimum of 18 inches in diameter and penetrate a minimum of 3 feet into the bearing stratum to utilize the full amount of end bearing.

Straight-sided drilled shafts may be designed to transfer imposed loads into the bearing stratum using a combination of end-bearing and skin friction as outlined in Table 1 below. As there is appreciable strain-compatibility between the various shale strata, the side friction capacities of all shale strata may be utilized in the shaft design.

The allowable side frictions noted in Table 1 may be taken within the weathered shale strata from a depth of 10 feet below current or finished grades, or from the bottom of any temporary casing used, whichever is deeper, to resist both axial loading and uplift.

Table 1. Recommended Drilled Shaft Allowable Bearing Parameters

Material	Depth Below Current Grades (ft)	Allowable Side Friction (psf)	Allowable End Bearing (psf)
Weathered Shale	10 – 15	1,200	NA
Weathered Shale	15 - 22	1,600	6,500
Fresh Shale	>22	2,000	10,000

The shafts should be provided with sufficient steel reinforcement throughout their length to resist potential uplift pressures that will be exerted. For the near surface soils, we recommend using an uplift pressure of 750 psf over an average depth of about 10 feet. Typically, one-half (½) of a percent of steel by cross-sectional area is sufficient for this purpose (ACI 318). However, the final amount of reinforcement required should be determined based on the information provided herein, and should be the greater of that determination, or ACI 318. Uplift forces acting on individual shafts will be resisted by the dead weight of the structure, plus the concrete-to-bearing stratum adhesion acting on that portion of the shaft that is in intimate contact with the bearing stratum from a depth of 10 feet below current or finished grades, or from the bottom of any temporary casing used, whichever is deeper.

There is no reduction in allowable capacities for shafts in proximity to each other. However, for a two-shaft system, there is an 18 percent reduction in the available perimeter area for side friction capacity for shafts in contact (tangent). The area reduction can be extrapolated linearly to zero at one shaft diameter clear spacing. Please contact this office if other close proximity geometries need to be considered.

We anticipate that a straight-sided drilled pier foundation system designed and constructed in accordance with the information provided in this report will have a factor of safety in excess of 2.5 against shear failure and may experience settlements of small fractions of an inch.

6.1.1 Drilled Shaft Construction Consideration

Groundwater seepage was encountered within Borings B1, B3, and B4 at depths of 13 feet during drilling activities, and at depths ranging from 12 to 17 feet upon completion of drilling operations. Boring B2 was observed to be dry during and after completion of drilling activities. Groundwater levels may be anticipated to fluctuate with seasonal and annual variations in rainfall, and also may vary as a result of development and landscape irrigation. Groundwater is often contained within the joints, fractures and other rock mass defects present in bedrock strata. When intercepted, these defects can produce appreciable amounts of water for a period of time, especially if those defects are extensive and well inter-connected. Temporary casing should be locally available in the event that excessive groundwater seepage is encountered that cannot be controlled with conventional pumps, sumps, or other means, or in the event that excessive sidewall sloughing occurs.

The installation of all drilled piers should be observed by experienced geotechnical personnel during construction to verify compliance with design assumptions including: 1) verticality of the shaft excavation, 2) identification of the bearing stratum, 3) minimum pier diameter and depth, 4) correct amount of reinforcement, 5) proper removal of loose material, and 6) that groundwater seepage, if present, is properly controlled. D&S would be pleased to provide these services in support of this project.

During construction of the drilled shafts, care should be taken to avoid creating an oversized cap ("mushroom") near the ground surface that is larger than the shaft diameter. These “mushrooms” provide a resistance surface that near-surface soils can heave against. If near-surface soils are prone to sloughing, a condition which can result in “mushrooming”, the tops of the shafts should be formed in the sloughing soils using cardboard or other circular forms equal to the diameter of the shaft.

Concrete used for the shafts should have a slump of 8 inches ± 1 inch. Individual shafts should be excavated in a continuous operation and concrete should be placed as soon as after completion of the drilling as is practical. All pier holes should be filled with concrete within 8 hours after completion of drilling. In the event of equipment breakdown, any uncompleted open shaft should be backfilled with soil to be redrilled at a later date. This office should be contacted when shafts have reached the target depth but cannot be completed.

6.1.2 Pier-Supported Grade Beams

For pier-supported grade beams utilizing a structural floor system, a minimum void space of 6 inches should be provided beneath all grade beams and the floor slab. If a structurally suspended floor slab system is utilized, two methods

are typically utilized for constructing a suspended floor slab system. These include constructing a crawl space using pan and joist type construction utilizing either concrete or steel beams and raising the floor slab well above the underlying expansive soils or using cardboard carton forms to create a void.

If a pan and joist system is used, and if utility lines are suspended beneath the slab, the void space clearance should be increased to either a minimum of 2 feet to provide for access to these lines, or to provide a minimum of 6 inches clearance below the lowest suspended utility. Flexible connections or oversized penetration sleeves should be considered in the design of utilities to accommodate potential future movements of soil supported utility lines, especially where these lines approach or enter stationary elements or structures. If a crawl space is employed, provisions should be made for positive drainage of the crawl space floor. Sufficient ventilation should also be provided where construction with metal beams and joists is planned, in order to limit corrosion of the metal components.

Structural cardboard carton forms (void boxes) or StormVoid™ carton forms may also be used to provide the required voids beneath the grade beams; however, trapezoidal void boxes should not be used. Care should be taken to assure that the void boxes are not allowed to become wet or are crushed prior to or during concrete placement and finishing operations. Masonite or other protective material should be placed on top of the carton forms per manufacturer recommendations to reduce the risk of crushing the cardboard forms during concrete placement and finishing operations. We strongly recommend that side retainers be placed along the grade beam carton forms to prevent soil from infiltrating the void space after the carton forms deteriorate. The bottoms of all grade beam excavations should be essentially free of any loose or soft material prior to the placement of concrete.

The bottoms of all grade beam excavations should be essentially free of any loose or soft material prior to the placement of concrete. All grade beams and floor slabs should be adequately reinforced to minimize cracking as normal movements occur in the foundation soils.

If grade beams are formed, the exterior side of the grade beams around the structure should be carefully backfilled with on-site clayey soils. The backfill soils should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D698 (standard Proctor), and should be placed at a moisture content that is at or above the optimum moisture, as determined by the same test. This fill should extend the full depth of the grade beam plus void space and a minimum distance of 2 feet away from the exterior grade beam perimeter.

6.2 Shallow Foundations

As an alternative to a drilled shaft foundation system, structural loads for the new additions may be supported on reinforced concrete, monolithic shallow continuous and/or isolated footings that are founded a minimum depth of 24 inches below the final exterior grade. Such footings may be designed using an allowable bearing capacity of 2,000 pounds per square foot (psf) when the foundations are based in properly prepared reworked soils. Footings should be a minimum of 16-inches in width for continuous footings and a minimum of 24-inches in width for isolated footings.

The bottom of all footing excavations should be essentially free of any loose or soft material prior to the placement of concrete. All footings and floor slabs should be adequately reinforced to minimize cracking, as normal movements will occur in the foundation soils.

If footings are formed, the exterior side of the footings around the structure should be carefully backfilled with on-site clayey soils. The backfill soils should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D698 (standard Proctor), and should be placed at a moisture content that is at or above the optimum moisture content, as determined by that same test. This fill should extend to the full depth of the footing and should extend a minimum distance of two feet away from the exterior footing perimeter.

All footings or footing segments should be constructed in a relatively seamless operation, with excavation activities and placement of the reinforcement steel and concrete occurring within 5 days. If concrete cannot be placed in newly excavated footings in a timely manner, the base of the excavated footing may be covered with a thin seal of lean concrete. We recommend that a qualified representative of a geotechnical engineer should observe all footing excavations prior to concrete placement to verify the competence of the bearing stratum. Any footing excavations that are left open overnight should be observed by the representative prior to concrete placement to determine the degree of stratum degradation and, if necessary, to recommend additional excavation where required. D&S would be pleased provide these services in support of this project.

6.3 Soil-Supported Floor System

A soil-supported floor slab in conjunction with a pier and beam system or a shallow foundation system may be utilized when the earthwork recommendations provided herein are implemented. A ground-supported floor system has an increased risk of potential vertical movement resulting from subgrade soil volume changes, which may occur as a result of changes in soil moisture content. The majority of such movement typically occurs in the perimeter 10 feet of buildings with slabs constructed with Finished Floor Elevations near those of the final exterior grades. Any walls bearing on the slab in the areas of movement may exhibit distress. We recommend that the

subgrade be prepared according to the Earthwork Recommendations section of this report in order to reduce the potential for post-construction movement to about 1-inch. The floor slab should be doweled to the grade beams at the locations of exterior doors in order to prevent vertical steps from forming at these high-traffic areas.

In order to reduce the effects of seasonal moisture fluctuations and subsequent possible soil movement beneath soil-supported floor slabs as described above, consideration is often given to the installation of a horizontal barrier around the perimeter of the structure. This barrier may be in the form of an independent barrier, such as a minimum 5-foot-wide sidewalk. The joints between the building and any sidewalks and pavements should be sealed and the seals inspected periodically and re-sealed as necessary through the life of the structure.

We understand that sidewalks are not always practical or desired around the full perimeters of some facilities. Where landscaping will be present adjacent to building perimeters, diligent post-construction maintenance should be employed to prevent excessive wetting or drying of those adjacent soils, while maintaining a consistent soil moisture condition around the foundations as much as possible throughout the year.

7.0 EARTHWORK RECOMMENDATIONS

The near-surface soils present have low potential for post-construction vertical movement with changes in subsurface soil moisture changes. Earthwork recommendations for structurally suspended foundation systems, soil-supported floor slabs, and flatwork are provided in the following sections.

7.1 Soil Preparation for Structurally Suspended Floor Slabs

- Strip the site of all vegetation, organic soil, and deleterious material within the new building area. Typically, 4 to 6 inches is sufficient for this purpose.

- After stripping and performing any required cuts, scarify, rework, and recompact the exposed subgrade to a depth of 12 inches. The scarified and reworked soils should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D698 (standard Proctor), and to a moisture content that is at or above the optimum moisture content, as determined by the same test. This procedure should extend at least 5 feet beyond the perimeter of the new structure.

- After scarifying and reworking the exposed subgrade, begin required fill operations using debris-free on-site or imported soil to no higher than the bottom of the void boxes. The grade-raise soil fill should be placed in maximum 8-inch compacted lifts and should be compacted in similar fashion to the scarified soils noted above.

- Place a minimum 15-mil thick vapor barrier beneath all floor slabs. The barrier should be securely bonded to the underside of the floor slab to promote continued contact after concrete placement. All seams and penetrations through the barrier should be sealed in accordance with the manufacturer's requirements.

7.2 Soil Preparation for Soil Supported Floor Slabs

If post-construction movements on the order of 1-inch can be tolerated, a soil-supported floor slab in conjunction with a pier and beam system or shallow footings may be used. We have the following recommendations for subgrade soil modification to provide a uniform building pad and limit the potential for post-construction soil related movements to the order of 1 inch or less.

- Strip the site of all vegetation, organic soil, and deleterious material within the new building areas. Typically, 4 to 6 inches is sufficient for this purpose.

- After stripping, excavate to a common elevation about 2 feet below existing or finished building pad elevation, whichever is deeper. Stockpile the excavated soil for possible re-use. The excavation should extend at least 5 feet beyond the perimeter of the new structure or to the edge of the existing building.

- After excavation, scarify, rework, and recompact the exposed excavated subgrade to a depth of 12 inches. The scarified and reworked soils should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D698 (standard Proctor), and to a moisture content that is at least one (1) percentage point above the optimum moisture content (≥ +1%) as determined by the same test.

- Within 24 hours of recompacting the reworked excavated subgrade, begin fill operations with the stockpiled onsite soils to no higher than 1-foot below finished subgrade elevation. The fill soil should be placed in maximum 8-inch compacted lifts and be compacted to at least 95 percent of the maximum dry density as determined by ASTM D698 (Standard Proctor) and be placed at a moisture content that is at least one (1) percentage point above the optimum moisture content (≥ +1%) as determined by the same test. Grade raise fill within the building pad areas may be onsite or imported select fill material having a Liquid Limit (LL) of 35 or less, a Plasticity Index (PI) between 6 and 18, a minimum of 30% of the material passing a No. 200 mesh sieve and be essentially free of particles in excess of 4 inches in their longest direction.

- Provide a minimum of 12 inches of select fill on top of the re-worked fill, but only within the confines of the building perimeter. Select fill should have a liquid limit of 35 or less, a plasticity index between 6 and 18, and a minimum of 35 percent passing the No. 200 sieve. The select fill should be placed in maximum 6-inch compacted lifts and compacted to at least 95 percent of the maximum density

as determined by ASTM D698, and to a moisture content of optimum or greater. Onsite soils meeting the liquid limit, plasticity index and percent passing No. 200 sieve requirements may be used as select fill.

- The moisture content of the subgrade should be maintained up to the time of concrete placement. Depending on the speed of the earthwork layers, on hot or windy days, sprinkling with water atop the subgrade may be required, to maintain the compaction moisture content.

- Water should not be allowed to pond on the prepared subgrade either during fill placement, or after reaching final subgrade elevation. To that end, and to the greatest degree possible, the subgrade surfaces should be shaped to shed water to the edges of the respective work areas.

- Place a minimum 15-mil thick vapor barrier beneath all floor slabs (Stego or equivalent) that will have coverings such as tile, carpet, etc. or that will be painted. All seams and penetrations through the barrier should be sealed in accordance with the manufacturer's requirements.

- Each lift of fill placed should be tested for moisture content and degree of compaction by a testing laboratory at the rate of one (1) test per 3,000 square feet of fill area, with a minimum of three (3) tests performed per lift within the building pad areas, one (1) test per lift per 100 linear feet of grade beam and/or footing perimeter backfill, and one (1) test per lift per 100 linear feet of utility trench backfill.

7.3 Soil Preparation for Flatwork at Student Entryways

In order to minimize the potential for differential movement between flatwork and building entryways used by students, consideration may be given to the design and construction of "hinge slabs" at these locations. Hinge slabs typically rest on top of the perimeter grade beam and commonly extend out from the building line to a distance on the order of 10 feet. They are usually supported on drilled shafts at their terminal end away from the structure. If utilized, the subgrade beneath these slabs should be prepared in similar manner to that of the new building and should incorporate void forms and side retainers. The joint at the building line should be sealed with an appropriate joint sealant and the joint should be periodically inspected and maintained as needed.

7.4 Additional Considerations

The following are considered to be best practices to minimize the potential for post-construction vertical movement.

- Where possible, trees or shrubbery with a mature height greater than 6 feet and/or that require excessive amounts of water should not be planted near structures or flatwork.

- We understand that local code may require tree plantings that may encroach on pavements. To the extent possible, trees should not be planted closer than the mature tree's height from structures or flatwork.

- Water should not be allowed to pond next to the foundations. Rainfall roof runoff should be collected and conveyed to downspouts. Downspouts should be directed to discharge at least 5 feet away from the foundations

- The moisture content of subgrade soils that are in proximity to the structures should be maintained as close as possible to a consistent level throughout the year. We strongly recommend that excessive watering near foundations be avoided.

8.0 PAVEMENT RECOMMENDATIONS

8.1 General

The pavement design recommendations provided below are derived from the subgrade information obtained from our geotechnical investigation, our experience with similar projects in this area and from the guidelines and recommendations of the American Concrete Pavement Association (ACPA). However, it is ultimately the responsibility of the Civil Engineer of Record and/or other design professionals to seal the final pavement plans and associated specifications for this project.

8.2 Behavior Characteristics of Soils Beneath Pavement

Near-surface soils at this site are considered to have some potential for volume change with changes in soil moisture content. The moisture content can be "stabilized", to some degree, in these soils by covering them with an impermeable surface, such as pavement. However, if moisture is introduced by surface or subsurface water, poor drainage, or the addition of excessive irrigation after periods of no moisture, or if moisture is removed by desiccation from vegetation (especially trees), the soils can swell or shrink causing distress to pavements in contact with the soil in the form of cracks.

The edges of pavements are particularly prone to moisture variations; therefore, these areas often experience the most distress (cracking, displacement, etc.). When cracks appear on the surface of the pavement, these openings can allow moisture to enter the pavement subgrade, which can lead to further weakening of the pavement section as well as accelerated failure of the pavement surface.

In order to minimize the potential impacts of expansive soil on paved areas and to improve the long-term performance of the pavement, we have the following recommendations:

- Design a crowned pavement which provides maximum drainage away from the pavement. A minimum slope of 5 percent within the first 5 feet is considered ideal.

- Subgrade treatments intended to reduce the soil's potential for vertical movement and to increase the subgrade stability should extend to at least two (2) feet beyond the back of curbs or edges of pavements.

8.3 Subgrade Strength Characteristics

The anticipated subgrade soils in the proposed paving areas will generally consist of clayey sand soils. We recommend that a California Bearing Ratio (CBR) value of 4 be used for the on-site clay soils in the design, with a corresponding resilient modulus of 5,000 psi. For cement treated soils or compacted aggregate base, we recommend using a resilient modulus of 20,000 psi.

8.4 Pavement Subgrade Preparation

The anticipated subgrade soils in the proposed paving areas will consist of clayey sand and sandy lean clay. These soils can become weak with appreciable increases in moisture content. A commonly used method to reduce the potential for pumping, improve the strength properties of the subgrade soils, provide a working platform, reduce PVM and provide a uniform subgrade is to treat them with cement or hydrated lime depending on the PI of the typical soil to be encountered. For PI's greater than about 20, lime is generally preferred. For soils that are predominantly sandy with PI's less than about 20, cement is generally preferred. For this site, PI's within the upper soils are generally in a range from 12 to 17 and are predominantly sandy soils. As such, cement treatment is recommended. As an alternative to cement treatment, a layer of compacted aggregate base may be used. To that end, we have the following recommendations:

- Strip the pavement areas of all vegetation and remove any remaining organic or deleterious material including tree roots, root balls, and matted roots. Typically, 6 to 12 inches are sufficient for this purpose.

- After stripping and performing necessary cuts, the exposed subgrade should be proof rolled. Proof rolling should consist of rolling the entire pavement subgrade with a heavily-loaded, tandem-axle dump truck weighing at least 25 tons or other approved equipment capable of applying similar loading conditions. Any soft, wet, or weak soils that are observed to rut or pump excessively during proof rolling should be removed and replaced with well-compacted, on-site clayey

material as outlined below. The proof rolling operation should be performed under the observation of a qualified geotechnical engineer representative.

- In areas to receive fill, fill may be derived from on-site or may be imported. The fill should be placed in maximum 6-inch compacted lifts, compacted to at least 95 percent of the maximum dry density, as determined by ASTM D698 (standard Proctor), and be placed at a moisture content that is at or above the optimum moisture content, as determined by the same test. Prior to compaction, each lift of fill should first be processed throughout its thickness to break up and reduce clod sizes and blended to achieve a material of uniform density and moisture content. Once blended, compaction should be performed with a heavy tamping foot roller. Once compacted, if the surface of the embankment is too smooth, it may not bond properly with the succeeding layer. If this occurs, the surface of the compacted lift should be roughened and loosened by dicing before the succeeding layer is placed.

- Water required to bring the fill material to the proper moisture content should be applied evenly through each layer. Any layers that become significantly altered by weather conditions should be reprocessed in order to meet recommended requirements. On hot or windy days, the use of water spraying methods may be required in order to keep each lift moist prior to placement of the subsequent lift. Furthermore, the subsurface soils should be kept moist prior to placing the pavement by water sprinkling or spraying methods.

- Fill materials should be placed on a properly prepared subgrade as outlined above. The combined excavation, placement, and spreading operation should be performed in such a manner as to obtain blending of the material, and to assure that, once compacted, the materials will have the most practicable degree of compaction and stability. Materials obtained from on-site must be mixed and not segregated.

- Soil imported from off-site sources should be tested for compliance with the recommendations herein and approved by the project geotechnical engineer prior to being used as fill. Imported materials shall consist of clayey sand and sandy lean clays (maximum Plasticity Index of 20) that are essentially free of organic materials and particles larger than 4 inches in their maximum dimension.

- Treat the subgrade soils with cement or place aggregate base in accordance with the recommendations outlined in subsequent sections.

- Once cement treatment is performed or aggregate base has been placed, water should not be allowed to pond on the treated surface. To that end, the pavement subgrade surface should be shaped in a way that will allow water to shed from one or more edges of the prepared subgrade.

- Field density and moisture content testing should be performed at the rate of one (1) test per lift per 100 linear feet in pavement areas.

8.4.1 Cement Treatment Recommendations

Once the subgrade is brought to rough grade, the upper soils may be treated with cement to achieve the final treatment depth recommended. We have the following recommendations for subgrade cement-treatment:

- Cement treated subgrade should be prepared in accordance with TxDOT Item 275 to subgrade elevations using an estimated five (5) percent cement by dry weight measure of the subgrade soil. The actual percentage to be used should be determined once the subgrade is at rough grade elevation. The amount of cement used should be the minimum amount required to achieve a 7-day cured unconfined compressive strength of 100 pounds per square inch.

- Cement should be applied such that mixing operations for a given area can be completed during the same working day.

- The cement may be placed dry or by the slurry method (meaning that the cement should be mixed with water in trucks or in tanks and applied as a thin slurry).

- After mixing, the soil-cement mixture should be tested for sufficient pulverization and mixing in accordance with TxDOT Item 275. The mixed material should meet the following requirements when tested dry by laboratory sieves:

    - Minimum passing 1¾" sieve: 100%
    - Minimum passing ¾” sieve: 85%
    - Minimum passing No. 4 sieve: 60%

- After sufficient mixing, the soil / cement mixture should be compacted to a minimum of 95% of Standard Proctor (ASTM D698) and to a moisture content that is at or above the optimum moisture, as determined by that same test. Compaction should be completed within 2 hours after the application of water to the mixture of soil and cement.

- Cure for at least 3 days by “sprinkling” as described in TxDOT Item 204.

- To reduce the potential for subgrade soil moisture changes at the edges of pavements, the cement stabilized subgrade should extend a minimum of 2 feet past the back of the roadway curbs.

- In order to reduce the potential for reflective cracking up through the pavement, particularly with asphalt pavement, the cement treated subgrade should be rolled with a vibratory roller 1 to 2 days after final compaction to create a network of hairline cracks (microcracking). Cure for at least 2 days by “sprinkling” as described in TxDOT Item 204 after completion of microcracking. Field density and moisture content testing should be performed at the rate of one (1) test per lift per 100 linear feet in drive lanes.

8.4.2 Aggregate Base

As an alternative to cement treatment, aggregate base may be placed over the prepared subgrade in accordance with the following recommendations prior to placing the pavement.

- Aggregate base should be TxDOT Type A or D and meet the gradation, durability and plasticity requirements of TxDOT Item 247 Grade 1-2 or better (2014). Aggregate base material should be uniformly compacted in maximum 6-inch compacted lifts to a minimum of 95% of the maximum standard Proctor dry density (ASTM D698) and placed at a moisture content that is sufficient to achieve density.

- After proof rolling, and prior to the placement of aggregate base, the exposed subgrade beneath pavement areas should be scarified and reworked to a depth of 12 inches, moisture added or removed as required, and the subgrade soils recompacted to a minimum of 95 percent of the maximum dry density of the materials obtained in accordance with ASTM D698 (standard Proctor test) and that is at or above the material’s optimum moisture content, as determined by the same test. The rework and aggregate base should extend to at least 24-inches beyond the outside edges of curbs.

- Field density and moisture content testing should be performed at a rate of one (1) test per lift per 100 linear feet in pavement areas.

8.5 Rigid Pavement

We recommend that Portland Cement Concrete Pavement for this site have a minimum thickness of 6 inches for light duty automobile parking over a minimum 6-inches of cement treated subgrade or aggregate base. Concrete thickness should be increased to 7 inches for fire lanes, heavy-duty traffic areas, and for dumpster pads and service areas over 8-inches of cement treated subgrade or aggregate base as described above. Actual traffic loading, frequency, and intensity may require an increase in these minimum recommendations, as may local governing design criteria. We have the following concrete mix design recommendations:

- Recommended minimum design compressive strength: 3,500 psi.
- 15 to 20 percent fly ash may be used with the approval of the Civil Engineer of record
- Curing compound should be applied within one hour of finishing operations

8.5.1 Pavement Reinforcing Steel

We recommend that a minimum of 0.1 percent of steel be used for all concrete pavements. For a 6-inch-thick concrete pavement section, this reinforcement ratio is approximately equivalent to No. 3 bars spaced at 18-inches on-center. Reinforcement requirements may increase depending on specific traffic loading and design life parameters.

8.5.2 Pavement Joints and Cutting

Concrete pavements should have adequately spaced contraction joints in order to control shrinkage cracking. Past experience indicates that reinforced concrete pavements with sealed contraction joints spaced at 12 to 15-foot intervals and cut to a depth of 1/4 to 1/3 of the pavement thickness generally exhibit less uncontrolled post-construction cracking than pavements with wider spacing. The contraction joint pattern should divide the pavement into panels that are approximately square, where the panel length does not exceed the panel width by more than 25 percent. Post-placement formed contraction joints should be installed as soon as the concrete can support the saw cutting equipment and personnel but before shrinkage cracks begin to appear (about six to twelve hours after concrete placement).

Isolation joints should be used wherever the pavement will abut a structural element that is subject to differential movement, such as light poles, retaining walls, existing pavement, stairways, and entryway piers, building walls or manholes.

In order to reduce potential differential movement across the pavements resulting from infiltration of surface water, all joints should be adequately sealed. Rubberized asphalt, silicone, or other suitable flexible sealant may be used to seal the joints. Maintenance should include periodic inspection of these joints, which should be resealed, as necessary. A flexible joint material should be used to seal cracks as they degrade, which can occur during the design life of pavements.

8.6 Grading and Drainage

Proper drainage is critical to the performance of the paved areas and should be provided both during and after construction. Positive surface drainage should be provided that directs surface water away from pavement edges. Where possible, we

recommend that a slope of at least 5 percent be provided. The slopes should direct water away from the flatwork and other structures and should be maintained throughout construction and the life of the structures.

9.0 OTHER CONSTRUCTION

9.1 Utility and Service Lines

Backfill for utility lines should consist of on-site material and should be placed in accordance with the following recommendations. The on-site fill soil should be placed in maximum 8-inch compacted lifts, be compacted to a minimum of 95 percent of the maximum dry density, as determined by ASTM D698 (standard Proctor), and placed at a moisture content that is at least one percentage points above the optimum, as determined by that same test (≥+1%). It is not uncommon to realize some settlement along the trench backfill. We also recommend that the utility trenches be visually inspected during the excavation process to ensure that undesirable fill that was not detected by the test borings does not exist at the site. This office should be notified immediately if any such fill is detected.

Utility lines connected to the structure may experience differential movement in response to changing moisture conditions in expansive soil. These movements may result in damage to the lines, especially at connections. Oversized penetration sleeves or flexible connections should be considered to account for potential differential movement between the building and utilities. Alternatively, utilities should extend below structural elements when crossing to enter a structure footprint.

Utility excavations should be sloped so that water within excavations will flow to a low point away from the active construction where it can be removed before backfilling. Compaction of bedding material should not be water jetted. Compacted backfill above the utilities should be on-site clays to limit the percolation of surface water. Utility trenches extending under structures should include fat clay or concrete cut-off collars at the perimeter/edge to prevent the transmission of water along trench lines.

9.2 Exterior Flatwork

Concrete flatwork should include high tensile steel reinforcement to reduce the formation and size of cracks. Flatwork should also include frequent and regularly spaced expansion/control joints and dowels to limit vertical offsets between neighboring flatwork slabs. Structure entrances should either be part of the structure or designed to tolerate vertical movement without inhibiting access. The moisture content of the subgrade should be maintained up to the time of concrete placement. If subgrade soils are allowed to dry below the levels recommended herein, additional moisture conditioning of the soils may be required. These recommendations are intended to reduce possible distress to exterior flatwork but will not prevent movement and/or vertical offsets between slabs. Recommendations for flatwork at student entryways are outlined in Section 7.3 of this report.

9.3 Surface Drainage

Proper drainage is critical to the performance and condition of the building foundation, pavements, and flatwork. Positive surface drainage should be provided that directs surface water away from the building, pavements and flatwork. We recommend that the exterior grades slope away from foundations at the rate of five (5) percent in the first ten (10) feet away in accordance with IBC Chapter 18 requirements. The slopes should direct water away from structures and flatwork, and these grades should be maintained throughout construction and the life of the structure.

The location of gutter downspouts, and other features, should be designed such that these items will not create moisture concentrations at or beneath the structure or flatwork. Downspouts should discharge well away from the structure and should not be allowed to erode surface soil.

The potential for moisture-induced distress can be positively addressed by constructing continuous exterior flatwork that extends to the building line. Where this occurs, the joints created at the interface of the flatwork and building line should be sealed with a flexible joint sealer to prevent the infiltration of water. Open cracks that may develop in the flatwork should also be sealed. The joint and any cracks that develop should be resealed as they become apparent and should be part of a periodic inspection and maintenance program.

However, we understand that sidewalks are not always practical or desired around the full perimeters of some facilities. Where landscaping will be present adjacent to building perimeters, diligent post-construction maintenance should be employed to prevent excessive wetting or drying of those adjacent soils.

9.4 Landscaping

Landscaping against and around the exterior of the structure can adversely affect subgrade moisture resulting in localized differential movements if not properly maintained. If used, landscaping should be kept as far away from the foundation as possible, and positive drainage away from the structure should be designed, constructed, and maintained. Landscaping elements (such as edging) should not prohibit or slow the drainage of water that could result in water ponding next to foundations or edges of flatwork. When feasible, irrigation lines and heads should not be placed in close proximity to the foundation to prevent the collection of water near the foundation or flatwork, particularly in the event of leaking lines or sprinkler heads.

Trees (if planned) should not be placed in proximity to the structure or movement sensitive flatwork, as trees are known to cause in localized soil shrinkage due to desiccation of the soil by the root system, possibly leading to differential movements of the structure. The desiccation zone varies by tree, but trees should not be planted closer to structures than the mature tree height, and in no case, should the dripline of

the mature tree extend closer than 10-feet of rooflines. To the extent practical, it is recommended that trees scheduled for removal (where required) in the vicinity of the proposed structure and pavements be removed as far in advance of slab construction as possible, ideally by several months or longer. This will tend to restore a more favorable soil moisture equilibrium which will, in turn, tend to minimize the potential for greater than anticipated post-construction ground movements. A moist but not overly wet soil condition should be maintained at all times in all landscaped areas near the building after construction to minimize soil volume changes caused by changing soil moisture conditions.

9.5 Site Grading

Expansive clay cut and fill slopes should be gentle and preferably should not exceed 4 horizontal to 1 vertical (4H: 1V).

Excess water ponding on and beside roadways, sidewalks, and ground-supported slabs can cause unacceptable heave of these structures. To reduce this potential heave, good surface drainage should be established. In addition, final grades in the vicinity of structures, pavements, and flatwork should provide for positive drainage away from these elements.

9.6 Excavations and Excavation Difficulties

Excavations greater than 5 feet in height/depth should be in accordance with OSHA 29CFR 1926, Subpart P. Temporary construction slopes should incorporate excavation protection systems or should be sloped back. Where the excavation does not extend close to building lines, these areas may be laid back. Where space allows, temporary slopes should be sloped at 1.5 horizontal to 1 vertical (1.5H: 1V) or flatter.

Where excavation slopes greater than five (5) feet in height cannot be laid back, these areas will require installation of a temporary retention system or shoring to protect the existing construction, restrain the subsurface soils and maintain the integrity of the excavation. We recommend that monitoring points be established around the retention system and that these locations be monitored during and after the excavation activities to confirm the integrity of the retention system.

The slopes and temporary retention system should be verified by and designed by the contractor's engineer and should not be surcharged by traffic, construction equipment, or permanent structures. The slopes and temporary retention system should be adequately maintained and periodically inspected to ensure the safety of the excavation and surrounding property.

10.0 SEISMIC CONSIDERATION

Based on past experience, the boring log data, and general geologic information gathered, we recommend that Soil Site Class “C” be used at this site.

11.0 LIMITATIONS

The professional geotechnical engineering services performed for this project, the findings obtained, and the recommendations prepared were accomplished in accordance with currently accepted geotechnical engineering principles and practices.

Variations in the subsurface conditions are noted at the specific boring locations for this study. As such, all users of this report should be aware that differences in depths and thicknesses of strata encountered can vary between the boring locations. Statements in the report as to subsurface conditions across the site are extrapolated from the data obtained at the specific boring locations. The number and spacing of the exploration borings were chosen to obtain geotechnical information for the design and construction of a lightly to moderately loaded institutional structure foundations. If there are any conditions differing significantly from those described herein, D&S should be notified to re-evaluate the recommendations contained in this report.

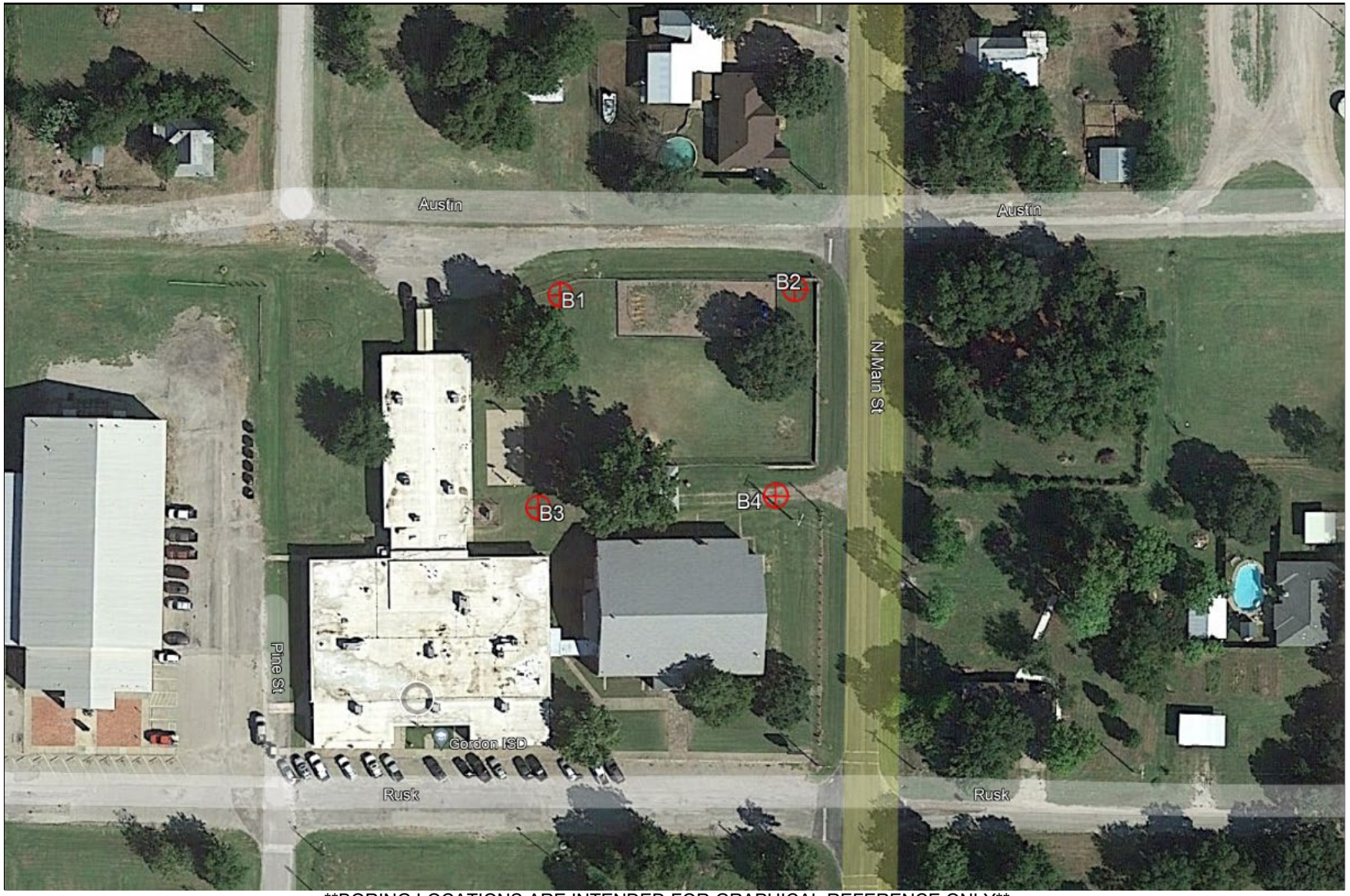
Recommendations contained herein are not considered applicable for an indefinite period of time. Our office must be contacted to re-evaluate the contents of this report if construction does not begin within a one-year period after completion of this report.

The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water, or groundwater.

All contractors referring to this geotechnical report should draw their own conclusions regarding excavations, construction, etc. for bidding purposes. D&S is not responsible for conclusions, opinions or recommendations made by others based on these data. The report is intended to guide preparation of project specifications and should not be used as a substitute for the project specifications.

Recommendations provided in this report are based on our understanding of information provided by the Client to us regarding the scope of work for this project. If the Client notes any differences, our office should be contacted immediately since this may materially alter the recommendations.

APPENDIX A - BORING LOGS AND SUPPORTING DATA



BORING LOCATIONS ARE INTENDED FOR GRAPHICAL REFERENCE ONLY

D&S ENGINEERING LABS

N.T.S.

PLAN OF BORINGS

GORDON ISD SECONDARY FACILITY

GORDON

TEXAS

SHEET NO.

G1

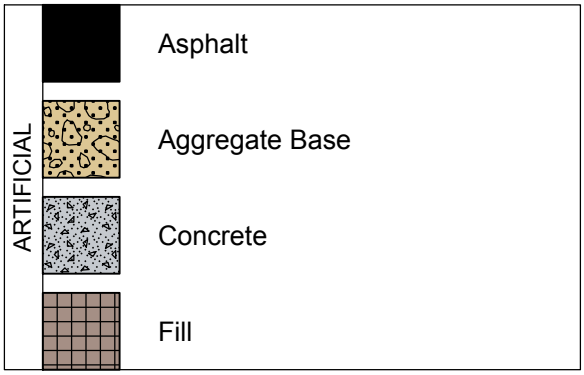
DATE DRILLED

February 16, 2022

D&S ENGINEERING LABS

KEY TO SYMBOLS AND TERMS

LITHOLOGIC SYMBOLS



CONSISTENCY OF SOILS

CONSISTENCY: FINE GRAINED SOILS		
Consistency	SPT (# blows/ft)	UCS (tsf)
Very Soft	0 - 2	< 0.25
Soft	3 - 4	0.25 - 0.5
Medium Stiff	5 - 8	0.5 - 1.0
Stiff	9 - 15	1.0 - 2.0
Very Stiff	16 - 30	2.0 - 4.0
Hard	> 30	> 4.0

CONDITION OF SOILS

CONDITION: COARSE GRAINED SOILS			
Condition	SPT (# blows/ft)	TCP (#blows/ft)	Relative Density (%)
Very Loose	0 - 4	< 8	0 - 15
Loose	5 - 10	8 - 20	15 - 35
Medium Dense	11 - 30	20 - 60	35 - 65
Dense	31 - 50	60 - 100	65 - 85
Very Dense	> 50	> 100	85 - 100

SECONDARY COMPONENTS

QUANTITY DESCRIPTORS	
Trace	< 5% of sample
Few	5% to 10%
Little	10% to 25%
Some	25% to 35%
With	> 35%

RELATIVE HARDNESS OF ROCK MASS

Designation	Description
Very Soft	Can be carved with a knife. Can be excavated readily with point of pick. Pieces 1" or more in thickness can be broken by finger pressure. Readily scratched with fingernail.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows with the pick point. Small, thin pieces can be broken by finger pressure.
Medium Hard	Can be grooved or gouged 1/4" deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1" maximum size by hard blows with the point of a pick.
Moderately Hard	Can be scratched with knife or pick. Gouges or grooves 1/4" deep can be excavated by hard blow of the point of a pick. Hand specimens can be detached by a moderate blow.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach a hand specimen.
Very Hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows from a hammer or pick.

WEATHERING OF ROCK MASS

Designation	Description
Fresh	No visible sign of weathering
Slightly weathered	Penetrative weathering on open discontinuity surfaces, but only slight weathering of rock material
Moderately weathered	Weathering extends throughout rock mass, but the rock material is not friable
Highly weathered	Weathering extends throughout rock mass, and the rock material is partly friable
Completely weathered	Rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved
Residual Soil	A soil material with the original texture, structure, and mineralogy of the rock completely destroyed

D&S ENGINEERING LABS

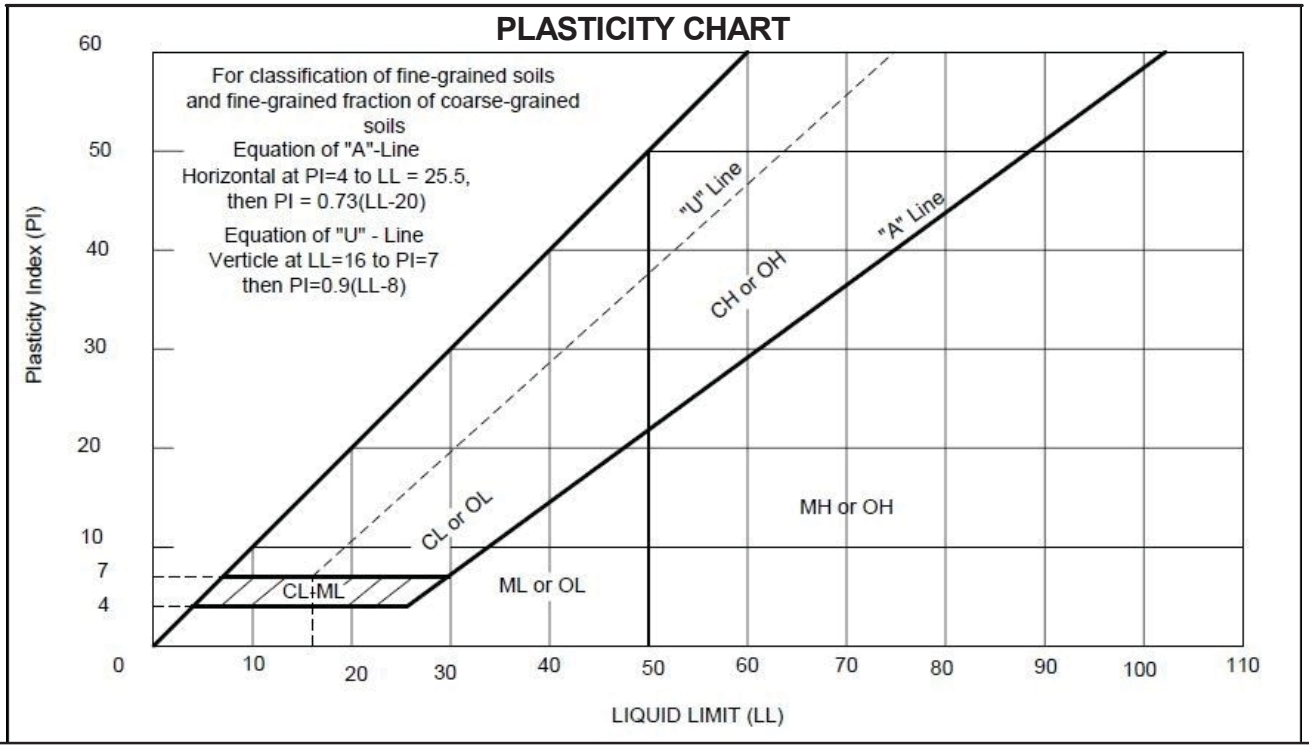
UNIFIED SOIL CLASSIFICATION SYSTEM

ADAPTED FROM ASTM D 2487

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS				GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS RETAINED ON THE NO. 200 SIEVE	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	$Cu \geq 4$ and $1 \leq Cc \leq 3$	**GW**	WELL-GRADED GRAVEL
			$Cu < 4$ and/or $[Cc < 1$ or $Cc > 3]$	**GP**	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES (MORE THAN 12% FINES)	Fines classify as ML or MH	**GM**	SILTY GRAVEL
			Fines classify as CL or CH	**GC**	CLAYEY GRAVEL
	SANDS MORE THAN 50% OF COARSE FRACTION PASSING THE NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	$Cu \geq 6$ and $1 \leq Cc \leq 3$	**SW**	WELL-GRADED SAND
			$Cu < 6$ and/or $[Cc < 1$ or $Cc > 3]$	**SP**	POORLY-GRADED SAND
		SANDS WITH FINES (MORE THAN 12% FINES)	Fines classify as ML or MH	**SM**	SILTY SAND
			Fines classify as CL or CH	**SC**	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL PASSES THROUGH THE NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC	PI > 7 and plots on or above "A" line	**CL**	LEAN CLAY
			PI < 4 or plots below "A" line	**ML**	SILT
		ORGANIC	$\frac{Liquid\ limit - oven\ dried}{Liquid\ limit - not\ dried} < 0.75$	**OL**	ORGANIC CLAY ORGANIC SILT
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	INORGANIC	PI plots on or above "A" line	**CH**	FAT CLAY
			PI plots below "A" line	**MH**	ELASTIC SILT
		ORGANIC	$\frac{Liquid\ limit - oven\ dried}{Liquid\ limit - not\ dried} < 0.75$	**OH**	ORGANIC CLAY ORGANIC SILT
HIGHLY ORGANIC SOILS	PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR			**PT**	PEAT

PLASTICITY CHART



D&S ENGINEERING LABS

BORING LOG

B1

PROJECT: Gordon ISD Secondary Facility
CLIENT: Gordon ISD
PROJECT NUMBER: G21-2350
START DATE: 2/18/2022 FINISH DATE: 2/18/2022
LOGGED BY: Ismael Hernandez (D&S)

LOCATION: Gordon, TX
GPS COORDINATES: N32.552325, W98.370705
GROUND ELEVATION: Approx. 952 feet
DRILL METHOD: Cont. Flight Auger
DRILLED BY: Octavio Herrera (D&S)

Legend:
- S-Shelby Tube
- N-Standard Penetration
- T-Texas Cone Penetration
- C-Core
- B-Bag Sample
- ▽ - Water Encountered

Depth (ft)	Sample Type	Hand Pen. (tsf) or SPT or TCP	Graphic Log		REC (%) RQD (%)	MC (%)	Atterberg Limits LL (%)	Atterberg Limits PL (%)	Atterberg Limits PI	Passing #200 Sieve (%)	Total Suction (pF)	Clay (%)	Swell (%)	DUW (pcf)	Unconf. Compr. Str (ksf)
0	S	4.5		**SANDY LEAN CLAY (CL);** very stiff; orange, dark brown, light brown; trace iron oxide stains, calcareous nodules, and sandstone fragments; occasional sand and shale seams											
	S	4.5													
	S	4.5				12.5	28	13	15				0.0	109.4	
	S	4.5				19.6									
5	S	4.5				18.2								112.4	8.0
	T	8, 6													
	S	4.5				8.8									
	S	1.0													
10						19.4									
	T	50=5.0", 29		**SHALE;** highly to completely weathered; soft to medium hard; light brown; trace sandstone fragments and sand											
15	B														
	T	33, 50=2.25"													
20	B														
	T	38, 42													
				21.0 ft / 931.0 ft — **SHALE;** fresh; soft; dark gray											
25	B														
	T	50=5.25", 39		25.9 ft / 926.1 ft — End of boring at 25.9'											
30				Notes: -seepage at 13 feet during drilling -water at 12 feet upon completion											
35															

D&S ENGINEERING LABS

BORING LOG

B2

PROJECT: Gordon ISD Secondary Facility
CLIENT: Gordon ISD
PROJECT NUMBER: G21-2350
START DATE: 2/18/2022 FINISH DATE: 2/18/2022
LOGGED BY: Ismael Hernandez (D&S)

LOCATION: Gordon, TX
GPS COORDINATES: N32.552337, W98.370217
GROUND ELEVATION: Approx. 952 feet
DRILL METHOD: Cont. Flight Auger
DRILLED BY: Octavio Herrera (D&S)

Legend: ■ S-Shelby Tube; ☒ N-Standard Penetration; ▽ T-Texas Cone Penetration; ◧ C-Core; ◪ B-Bag Sample; ▽ - Water Encountered

Depth (ft)	Sample Type	Hand Pen. (tsf) or SPT or TCP	Graphic Log		REC (%) RQD (%)	MC (%)	Atterberg Limits LL (%)	Atterberg Limits PL (%)	Atterberg Limits PI	Passing #200 Sieve (%)	Total Suction (pF)	Clay (%)	Swell (%)	DUW (pcf)	Unconf. Compr. Str (ksf)
0	S	2.0		**CLAYEY SAND (SC);** medium dense; orange, brown; trace ferrous nodules		12.5									
	S	2.0													
	S	2.5		3.0 ft											
	S	2.0		**SANDY LEAN CLAY (CL);** stiff to very stiff; light brown; trace calcareous deposits and limestone fragments 949.0 ft		15.1	37	17	20						
5	S	2.5				14.3								116.8	6.2
	T	10, 11													
	S	4.5				14.6									
	S	3.0													
	S	4.5				15.2									
10	S	4.5		10.0 ft											
	T	24, 22		**SHALE;** highly to completely weathered; soft to medium hard; brown; trace sandstone fragments -interbedded limestone 942.0 ft											
15	B														
	T	50=5.0", 50=3.0"													
20	B			20.0 ft											
	T	50=2.0", 50=1.5"		**SHALE;** fresh; soft to medium hard; dark gray 932.0 ft											
25	B														
	T	50=5.0", 33		25.9 ft											
				End of boring at 25.9' 926.1 ft											
30				Notes: -dry during drilling -dry upon completion											
35															

D&S ENGINEERING LABS

BORING LOG

B3

PROJECT: Gordon ISD Secondary Facility
CLIENT: Gordon ISD
PROJECT NUMBER: G21-2350
START DATE: 2/18/2022 FINISH DATE: 2/18/2022
LOGGED BY: Ismael Hernandez (D&S)

LOCATION: Gordon, TX
GPS COORDINATES: N32.551973, W98.370777
GROUND ELEVATION: Approx. 953 feet
DRILL METHOD: Cont. Flight Auger
DRILLED BY: Octavio Herrera (D&S)

Legend:
- S-Shelby Tube
- N-Standard Penetration
- T-Texas Cone Penetration
- C-Core
- B-Bag Sample
- ▽ - Water Encountered

Depth (ft)	Sample Type	Hand Pen. (tsf) or SPT or TCP	Graphic Log		REC (%) RQD (%)	MC (%)	Atterberg Limits LL (%)	Atterberg Limits PL (%)	Atterberg Limits PI	Passing #200 Sieve (%)	Total Suction (pF)	Clay (%)	Swell (%)	DUW (pcf)	Unconf. Compr. Str (ksf)
0	S	4.0		**SANDY LEAN CLAY (CL);** very stiff; light brown, brown, orange; trace ferrous nodules and calcareous deposits; occasional sand laminations											
	S	4.5				12.3				64					
	S	4.5													
	S	4.5				15.8									
5	S	4.5													
	T	8, 8													
	S	2.5				12.3	31	13	18						
	S	2.5													
	S	4.5				13.3									
10	S	4.5													
				10.0 ft / 943.0 ft											
	T	8, 8		**SHALE;** moderately to highly weathered; very soft to medium hard; light gray, brown, orange; trace iron oxide stains; caclareous		8.6									
15	S	4.5													
	T	33, 50=3.25"													
20	B														
	T	40, 31													
				21.0 ft / 932.0 ft											
				SHALE; fresh; soft; light gray											
25	B														
	T	35, 50=3.75"													
				25.8 ft / 927.2 ft											
				End of boring at 25.8'											
30				Notes: -seepage at 13 feet during drilling -water at 15 upon completion											
35															

D&S ENGINEERING LABS

BORING LOG

B4

PROJECT: Gordon ISD Secondary Facility
CLIENT: Gordon ISD
PROJECT NUMBER: G21-2350
START DATE: 2/18/2022 FINISH DATE: 2/18/2022
LOGGED BY: Ismael Hernandez (D&S)

LOCATION: Gordon, TX
GPS COORDINATES: N32.552003, W98.370259
GROUND ELEVATION: Approx. 953 feet
DRILL METHOD: Cont. Flight Auger
DRILLED BY: Octavio Herrera (D&S)

Legend: ■ S-Shelby Tube; ☒ N-Standard Penetration; ▽ T-Texas Cone Penetration; ◧ C-Core; ◪ B-Bag Sample; ▽ - Water Encountered

Depth (ft)	Sample Type	Hand Pen. (tsf) or SPT or TCP	Graphic Log		REC (%) RQD (%)	MC (%)	Atterberg Limits LL (%)	Atterberg Limits PL (%)	Atterberg Limits PI	Passing #200 Sieve (%)	Total Suction (pF)	Clay (%)	Swell (%)	DUW (pcf)	Unconf. Compr. Str (ksf)
0	S	1.0		**CLAYEY SAND (SC);** medium dense; orange, brown											
	S	2.0													
	S	3.0				14.0	28	15	13				0.0	113.4	
	S	3.5				9.3									
5	S	4.5+		5.0 ft											
	T	7, 9		**SANDY LEAN CLAY (CL);** very stiff; orange, light brown, brown; some calcareous deposits; trace ferrous nodules; occasional sand laminations 948.0 ft											
	S	4.5+				16.5									
	S	4.5+													
	S	4.5+													
10	S	2.5		10.0 ft		17.0									
	T	10, 14		**SHALE;** moderately to highly weathered; very soft to medium hard; brown, gray; trace gravel; occasional sand seams 943.0 ft											
15	S	4.5				16.2								113.0	3.8
	T	19, 50=4.25"													
20	B														
	T	30, 26		21.0 ft											
				SHALE; fresh; very soft; light gray 932.0 ft											
25	B														
	T	25, 34		26.0 ft											
				End of boring at 26.0' 927.0 ft											
30				Notes: -seepage at 13 feet during drilling -water 17 feet upon completion											
35															

UNCONFINED COMPRESSION TEST

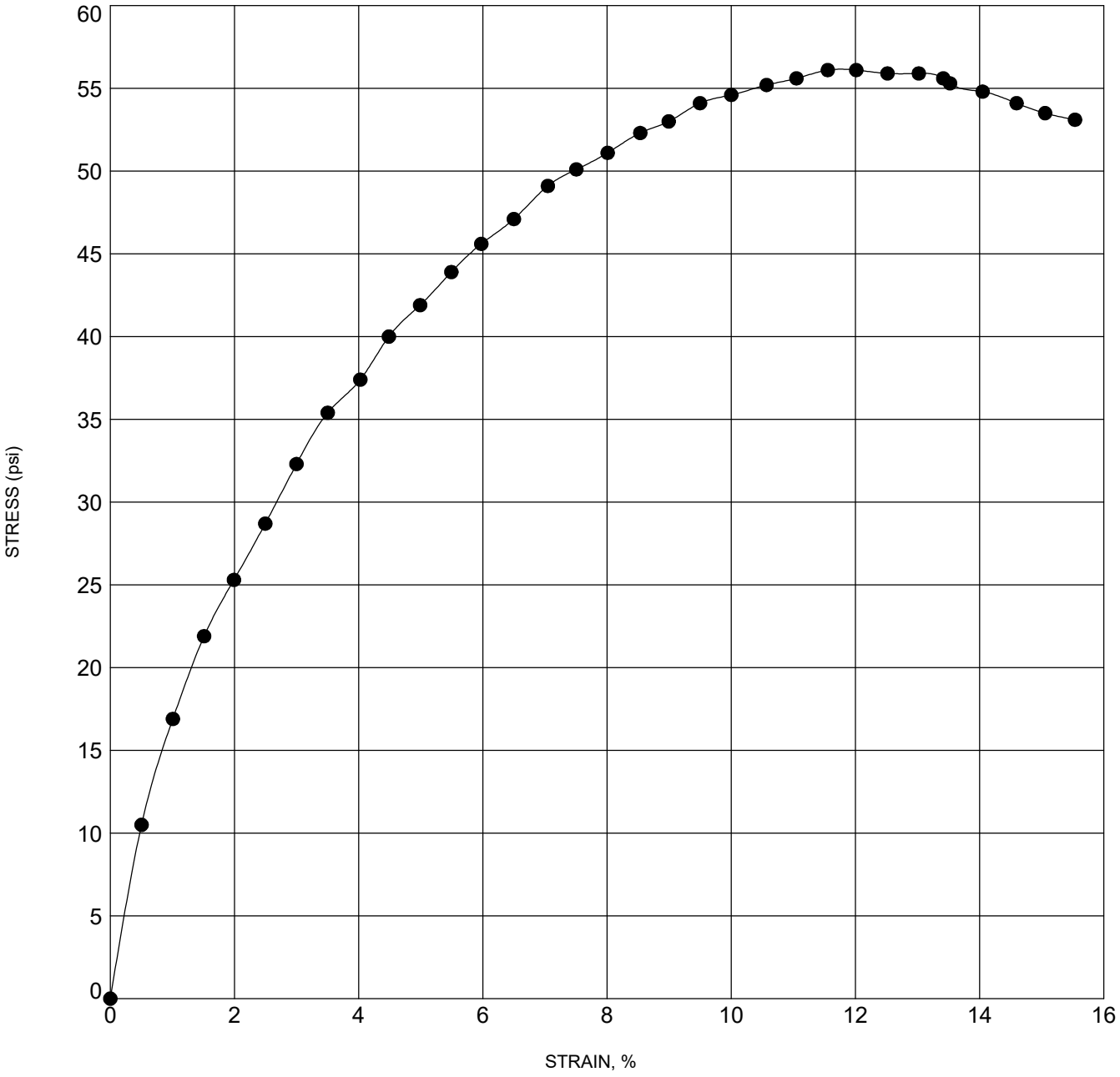
D&S ENGINEERING LABS

PROJECT: Gordon ISD Secondary Facility

CLIENT: Gordon ISD

PROJECT NUMBER: G21-2350

LOCATION: Gordon, TX



Borehole	Depth	Description	γ_d	MC%
B1	**4.0**	**SANDY LEAN CLAY (CL);** very stiff; orange, dark brown, light brown	**112.4**	**18.2**

UNCONFINED COMPRESSION TEST

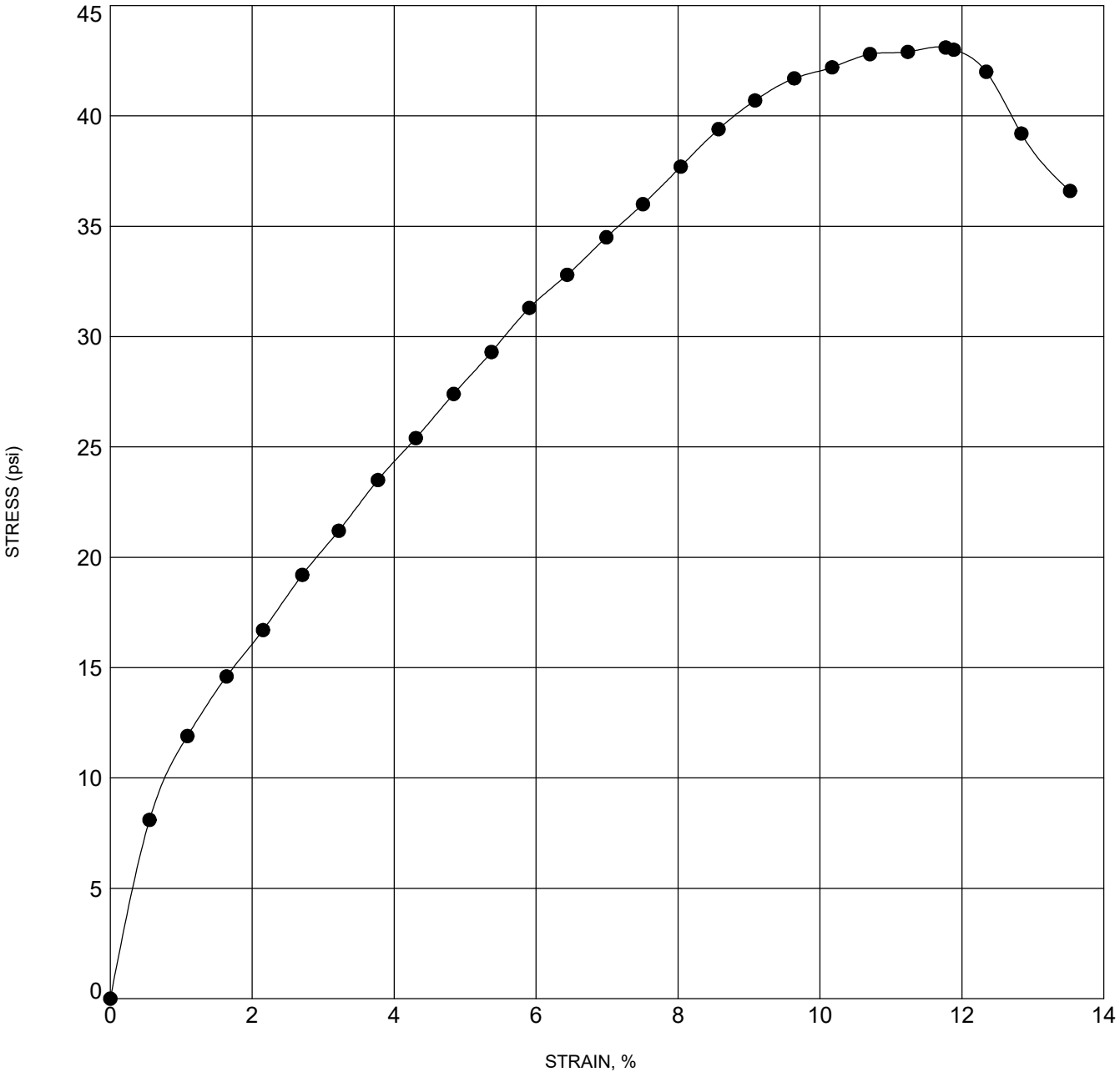
D&S ENGINEERING LABS

PROJECT: Gordon ISD Secondary Facility

CLIENT: Gordon ISD

PROJECT NUMBER: G21-2350

LOCATION: Gordon, TX



Borehole	Depth	Description	γ_d	MC%
● B2	4.0	**SANDY LEAN CLAY (CL);** stiff to very stiff; light brown	116.8	14.3

UNCONFINED COMPRESSION TEST

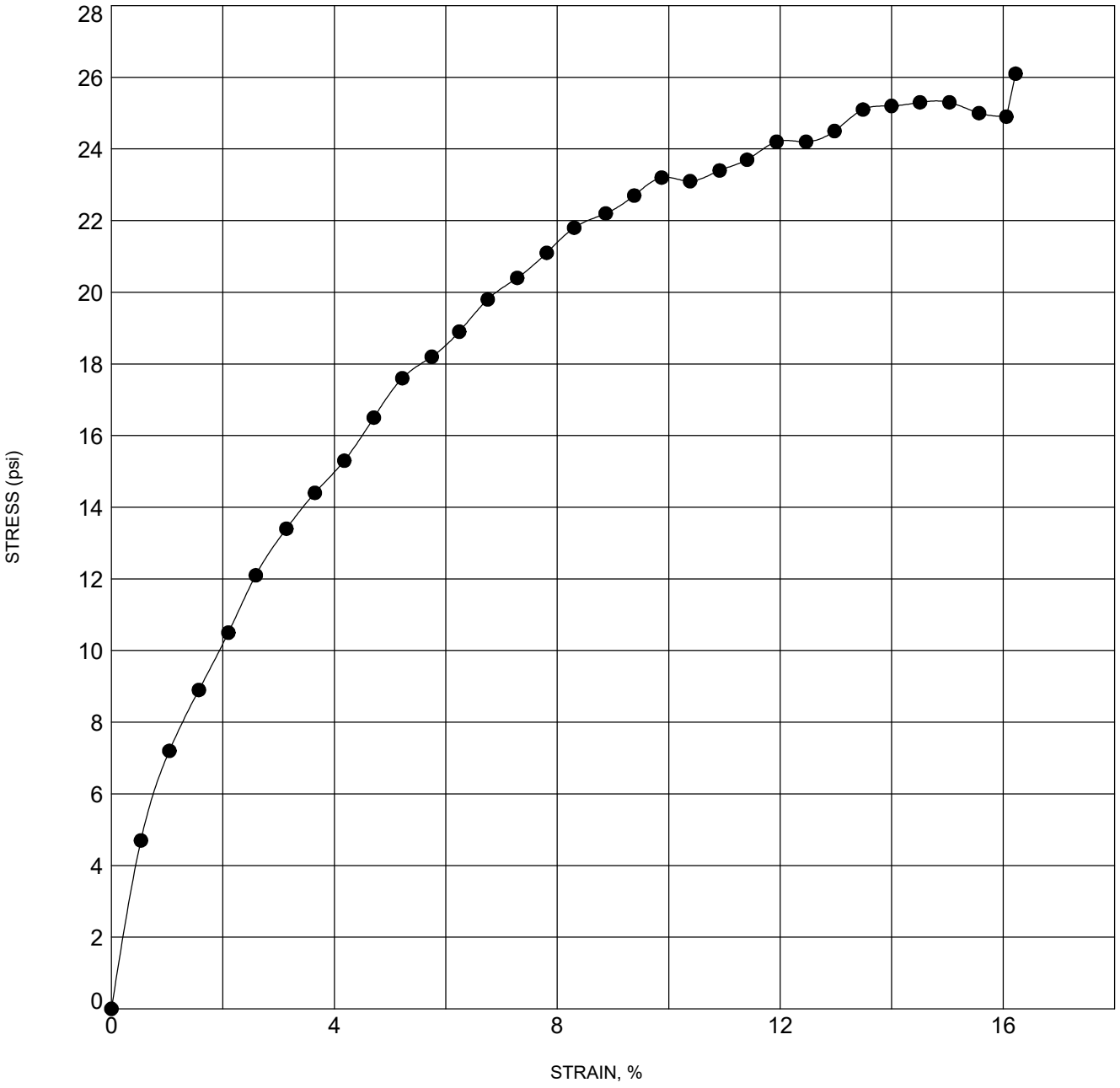
D&S ENGINEERING LABS

PROJECT: Gordon ISD Secondary Facility

CLIENT: Gordon ISD

PROJECT NUMBER: G21-2350

LOCATION: Gordon, TX



Borehole	Depth	Description	γ_d	MC%
● B4	14.0	**SHALE;** moderately to highly weathered; very soft to medium hard; brown, gray	113.0	16.2

D&S ENGINEERING LABS

SWELL TEST RESULTS

PROJECT: Gordon ISD Secondary Facility

CLIENT: Gordon ISD

PROJECT NUMBER: G21-2350

LOCATION: Gordon, TX

Boring Number	Depth feet	Initial Moisture Content, %	Final Moisture Content, %	Applied Pressure, psf	Vertical Swell, %
B1	2-3	12.5	19.1	260	0.0
B4	2-3	14.0	16.8	263	0.0

APPENDIX B- GENERAL DESCRIPTION OF PROCEDURES

ANALYTICAL METHODS TO PREDICT MOVEMENT

INDEX PROPERTY AND CLASSIFICATION TESTS

Index property and classification testing is perhaps the most basic, yet fundamental tool available for predicting potential movements of clay soils. Index property testing typically consists of moisture content, Atterberg Limits, and Grain-size distribution determinations. From these results a general assessment of a soil's propensity for volume change with changes in soil moisture content can be made.

Moisture Content

By studying the moisture content of the soils at varying depths and comparing them with the results of Atterberg Limits, one can estimate a rough order of magnitude of potential soil movement at various moisture contents, as well as movements with moisture changes. These tests are typically performed in accordance with ASTM D2216.

Atterberg Limits

Atterberg limits determine the liquid limit (LL), plastic limit (PL), and plasticity index (PI) of a soil. The liquid limit is the moisture content at which a soil begins to behave as a viscous fluid. The plastic limit is the moisture content at which a soil becomes workable like putty, and at which a clay soil begins to crumble when rolled into a thin thread (1/8" diameter). The PI is the numerical difference between the moisture constants at the liquid limit and the plastic limit. This test is typically performed in accordance with ASTM D4318.

Clay mineralogy and the particle size influence the Atterberg Limits values, with certain minerals (e.g., montmorillonite) and smaller particle sizes having higher PI values, and therefore higher movement potential.

A soil with a PI below about 15 to 18 is considered to be generally stable and should not experience significant movement with changes in moisture content. Soils with a PI above about 30 to 35 are considered to be highly active and may exhibit considerable movement with changes in moisture content.

Fat clays with very high liquid limits, weakly cemented sandy clays, or silty clays are examples of soils in which it can be difficult to predict movement from index property testing alone.

Grain-size Distribution

The simplest grain-size distribution test involves washing a soil specimen over the No. 200 mesh sieve with an opening size of 0.075 mm (ASTM D1140). This particle size has been defined by the engineering community as the demarcation between coarse-grained and fine-grained soils. Particles smaller than this size can be further distinguished between silt-size and clay-size particles by use of a Hydrometer test (ASTM D422). A more complete grain-size distribution test that uses sieves to relative amount of particles according is the Sieve Gradation Analysis of Soils (ASTM D6913). Once the characteristics of the soil are determined through classification testing, a number of movement prediction techniques are available to predict the potential movement of the soils. Some of these are discussed in general below.

POTENTIAL VERTICAL MOVEMENT

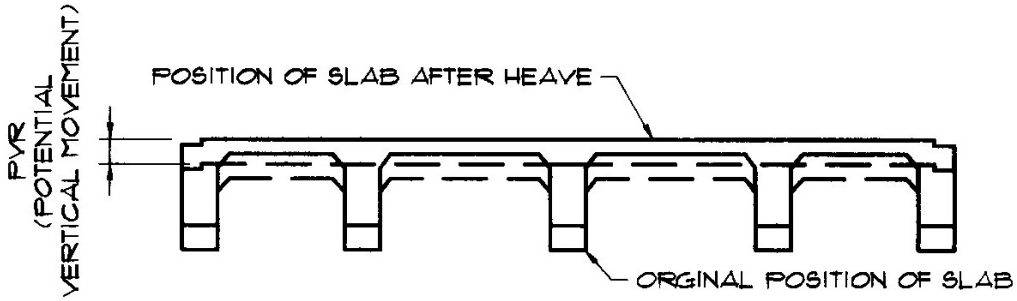
A general index for movement is known as the Potential Vertical Rise (PVR). The actual term PVR refers to the TxDOT Method 124-E mentioned above. For the purpose of this report the term Potential Vertical Movement (PVM) will be used since PVM estimates are derived using multiple analytical techniques, not just TxDOT methods.

It should be noted that all slabs and foundations constructed on clay or clayey soils have at least some risk of potential vertical movement due to changes in soil moisture contents. To eliminate that risk, slabs and foundation elements (e.g., grade beams) should be designed as structural elements physically separated by some distance from the subgrade soils (usually 6 to 12 inches).

In some cases, a floor slab with movements as little as 1/4 of an inch may result in damage to interior walls, such as cracking in sheet rock or masonry walls, or separation of floor tiles. However, these cracks are often minor and most people consider them 'livable'. In other cases, movement of one inch may cause significant damage, inconvenience, or even create a hazard (trip hazard or others).

Vertical movement of clay soils under slab on grade foundations due to soil moisture changes can result from a variety of causes, including poor site grading and drainage, improperly prepared subgrade, trees and large shrubbery located too close to structures, utility leaks or breaks, poor subgrade maintenance such as inadequate or excessive irrigation, or other causes. A sampling of more common moisture control procedures to reduce the potential for movement due to these causes is presented in Appendix C.

PVM is generally considered to be a measurement of the change in height of a foundation from the elevation it was originally placed. Experience and generally accepted practice suggests that if the PVM of a site is less than one inch, the associated differential movement will be minor and acceptable to most people.



POTENTIAL VERTICAL RISE

SETTLEMENT

Settlement is a measure of a downward movement due to consolidation of soil. This can occur from improperly placed fill (uncompacted or under-compacted), loose native soil, or from large amounts of unconfined sandy material. Properly compacted fill may settle approximately 1 percent of its depth, particularly when fill depths exceed 10 feet.

SPECIAL COMMENTARY ON CONCRETE AND EARTHWORK

RESTRAINT TO SHRINKAGE CRACKS

One of the characteristics of concrete is that during the curing process shrinkage occurs and if there are any restraints to prevent the concrete from shrinking, cracks can form. In a typical slab on grade or structurally suspended foundation there will be cracks due to interior beams and piers that restrict shrinkage. Similar restraint can occur when pavements are cast directly against rigid bedrock materials. This restriction is called Restraint to Shrinkage (RTS). These RTS cracks do not normally adversely affect the overall performance of foundations or pavements. It should be noted that for exposed floors, especially those that will be painted, stained or stamped, these cracks may be aesthetically unacceptable. Any tile which is applied directly to concrete or over a mortar bed over concrete has a high probability of minor cracks occurring in the tile due to RTS. It is recommended if tile is used to install expansion joints in appropriate locations to minimize these cracks.

UTILITY TRENCH EXCAVATION

Trench excavation for utilities should be sloped or braced in the interest of safety. Attention is drawn to OSHA Safety and Health Standards (29 CFR 1926/1910), Subpart P, regarding trench excavations greater than 5 feet in depth.

FIELD SUPERVISION AND DENSITY TESTING

Field density and moisture content determinations should be made on each lift of fill at a minimum rate of one (1) test per lift per 3,000 square feet of fill area, with a minimum of three (3) tests performed per lift of fill in each building pad area, one (1) test per lift per 100 linear feet of grade beam and/or footing perimeter backfill, one (1) test per lift per 100 linear feet of utility trench backfill, and one (1) test per lift per 100 linear feet of pavement area. Supervision by the field technician and the project engineer is required. Some adjustments in the test frequencies may be required based upon the general fill types and soil conditions at the time of fill placement.

It is recommended that all site and subgrade preparation, proof rolling, and pavement construction be monitored by a qualified engineering firm. Density tests should be performed to verify proper compaction and moisture content of any earthwork. Inspection should be performed prior to and during concrete placement operations. D&S would be pleased to perform these services in support of this project.

14805 Trinity Boulevard, Fort Worth, Texas 76155
Geotechnical 817.529.8464 Corporate 903.420.0014
www.dsenglabs.com
Texas Engineering Firm Registration # F-12796
Oklahoma Engineering Firm Certificate of Authorization CA 7181

D&S ENGINEERING LABS

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SECTION 004100 - BID FORM

THE PROJECT AND THE PARTIES

TO:

Gordon ISD - Holly Campbell, Superintendent
112 Rusk
Gordon, Texas76453

FOR:

Project: Gordon ISD Campus Additions and Renovations

Architect's Project Number: 20864.00

Architect: HPA

CMaR: Pete Durant & Associates

DATE: _____ (Bidder to enter date)

SUBMITTED BY: (Bidder to enter name and address)

Bidder's Full Name: _____

Address: _____

City, State, Zip: _____

Phone: _____

License No.: _____

1.01 OFFER

A. Having examined the Site, Construction Documents and all matters referred to in the Instructions to Bidders and the Bid Documents prepared by HPA for the above-mentioned project, we, the undersigned, hereby offer to execute the following portion(s) of the Work indicated for the Sum:

1. Bid Item #___: $ _____.
2. Bid Item #___: $ _____.
3. Bid Item #___: $ _____.
4. Bid Item #___: $ _____.

5. Bid Item #___: $ _____.

6. Bid Item #___: $ _____.
If additional lines are required, provide additional pages with this form.

B. Performance/Payment Bonds: The requirement for these Bonds will be at the discretion of the CMaR. Provide costs for these Bonds if required.

1. Performance Bond: Add: $ _____.

2. Payment Bond: Add: $ _____.

1.02 UNIT PRICES

A. The following are Unit Prices for specific portions of the Work as listed. The following is the list of Unit Prices:

No.	Item:	Unit:	When Added:	When Deducted:
1.	Painting	Sq. Ft.	$	$
2.	Concrete Paving	Sq. Ft.	$	$
3.	Concrete Curb and Gutter	Ln. Ft.	$	$
4.	Concrete Sidewalk	Sq. Ft.	$	$
5.	6" Sprinkler Line	Ln. Ft.	$	$
6.	4" Domestic water line	Ln. Ft.	$	$
7.	Drilled Piers	Ln. Ft	$	$
8.	Pier Casing	Ln. Ft.	$	$

1.03 ALTERNATES

A. Alternates: The following alternates are a part of this Bid Form and are attached hereto:

1. Alternate #___: $ _____.

2. Alternate #___: $ _____.

3. Alternate #___: $ _____.

4. Alternate #___: $ _____.

1.04 ALLOWANCES

A. The Contingency Allowance shall be submitted by the Proposer to be included in the total GMP. The use of Contingency funds can only be used upon approval by the Owner. Any unused Contingency will be credited at the end of the Project to the Owner.

1.05 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for sixty days from the bid closing date.

B. If this bid is accepted by Owner within the time period stated above, the CM@R will:
1. Execute the Agreement within seven days of receipt of acceptance of this bid.

1.06 CONTRACT TIME

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Owner and shall fully complete the Work within the time frame set forth by the CMaR.

1.07 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.

2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.

1.08 CONTRACTOR'S ACKNOWLEDGEMENTS

A. The undersigned states that it is a duly licensed contractor for the type of work proposed in Texas and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

B. Wage Scale: The undersigned acknowledges the Wage Scale as published in accordance with VCS 5159A and included herein as Section 008100 and understand payment of wages in accordance with this scale and statutes are a condition of the contract.

1.09 NON-COLLUSION NOTICE

A. I, the undersigned agent for the Firm, propose to provide the merchandise and/or services proposed within this document and, if awarded the proposal, do agree to abide by all conditions of the proposal. Furthermore, the undersigned affirms that they are truly authorized to execute this contract, that this company, corporation, firm, partnership or individual and has not prepared this proposal in collusion with any other Proposer, and the contents of this proposal, as to prices, terms or conditions of said proposal, have not been communicated by the undersigned or any employee or agent to any other person engaged in this type of business prior to the official opening of this bid.

1.10 RESIDENT BIDDER

As defined by Texas Government Code, Title 20, Subtitle F, Chapter 2252, Subchapter A, Sec. 2252.001, a “Resident bidder” refers to a person whose principal place of business in in Texas, including a contractor whose ultimate parent company or majority owner has its principal place of business in Texas and a “Nonresident bidder” refers to a person who in not a resident of Texas.

I the undersigned agent for the firm certify my company is a “Resident bidder” as defined above or if a non-resident bidder, that I have provided an attachment with information regarding my resident state.

1.11 FELONY CONVICTION NOTICE

A. I, the undersigned agent for the Firm:

1. Will obtain and certify in writing, before work begins, and at least annually, that the Contractor has received all criminal history record information that relates to an employee, applicant, agent, or subcontractor of the Contractor or a subcontractor, if the person has or will have continuing duties related to the contracted services, and the duties are or will be performed on Gordon ISD property.
2. Shall assume all expenses associated with the background checks and shall immediately remove any employee or agent who was convicted of, received probation for, or received deferred adjudication for any felony as outlined below from GISD's property.
3. Understand any contractors or subcontractors may not work on GISD property when they have been convicted, received probation or deferred adjudication for the following felony offenses:
   a. Any sex offense
   b. Any crimes against persons involving:
      1) Controlled substances; or
      2) Property; or
      3) Violence.
   c. Any other offense GISD believes might compromise the safety of employees or property.
4. Certify the information concerning notification of felony conviction and criminal history checks for the company employees, agents, or subcontractors connected with this project, have been reviewed by me, and shall be complied with.

1.12 BID FORM SIGNATURE(S)

Authorized Signature:_____(Handwritten signature).

Signed By:_____(Type or print name).

Title:_____(Owner/Partner/President/Vice President).

END OF SECTION 004100

SECTION 005000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 CMaR is responsible for obtaining a valid license to use all copyrighted documents specified but not included in the Project Manual.

1.02 AGREEMENT AND CONDITIONS OF THE CONTRACT

A. See Section 007200 - General Conditions for the General Conditions.

B. See Section 007300 - Supplementary Conditions for the Supplementary Conditions.

C. The Agreement is based on AIA A133.

D. The General Conditions are based on AIA A201.

1.03 FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

B. Bond Forms:
1. Performance and Payment Bond Form: Standard Insurance provided form.

C. Post-Award Certificates and Other Forms:
1. Certificate of Insurance Form: ACORD Certificate of Insurance 25.
2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).

D. Clarification and Modification Forms:
1. Architect's Supplemental Instructions Form.
2. Proposal Request Form.
3. Change Order Form: AIA G701.

E. Closeout Forms:
1. Certificate of Substantial Completion Form: AIA G704.
2. Affidavit of Payment of Debts and Claims Form: AIA G706.
3. Contractor’s Affidavit of Release of Liens Form: AIA G706A
4. Consent of Surety to Final Payment Form: AIA G707.

1.04 REFERENCE STANDARDS

A. AIA A133 - Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price 2019.

B. AIA A201 - General Conditions of the Contract for Construction 2017.

C. AIA G701 - Change Order 2017.

D. AIA G702 - Application and Certificate for Payment 1992.

E. AIA G703 - Continuation Sheet 1992.

F. AIA G704 - Certificate of Substantial Completion 2017.

G. AIA G706A - Contractor's Affidavit of Release of Liens 1994.

H. AIA G707 - Consent of Surety to Final Payment 1994.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 005000

SECTION 007200 - GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 The AIA Document A201-2017 General Conditions applicable to this contract is available upon request.

RELATED REQUIREMENTS

2.01 SECTION 007300 - Supplementary Conditions.

SUPPLEMENTARY CONDITIONS

3.01 REFER TO DOCUMENT 007300 - Supplementary Conditions FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF SECTION 007200

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SECTION 007300 - SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 007200 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 RELATED SECTIONS

A. Section 005000 - Contracting Forms and Supplements.

1.03 MODIFICATIONS TO A201-2017 GENERAL CONDITIONS

A. ARTICLE 3 CONTRACTOR Article 3.7 Permits, Fee, Notices and Compliance with Laws - ADD:

Article 3.7.2.1 Any reference in the Specifications text to standard specifications or manufacturer's instructions shall mean the latest printed edition of each in effect at the contract date.

B. ARTICLE 3 CONTRACTOR Article 3.7 Permits, Fee, Notices and Compliance with Laws - ADD:

Article 3.7.2.2 Any references to Codes shall be those as adopted by the City of Gordon - Authority having Jurisdiction over Gordon ISD.

C. ARTICLE 4 ARCHITECT Article 4.1.1 - ADD:

The term "Architect" as used herein refers to Harper Perkins Architects (HPA).

D. ARTICLE 9 PAYMENTS AND COMPLETION Article 9.2 Schedule of Values - ADD:

The schedule shall be divided into line items based on the Specification manual's table of contents. The minimum line items shall be one for each specification section.

E. ARTICLE 11 INSURANCE AND BONDS Article 11.1.1 - ADD:

The Contractor shall use insurance carriers acceptable to and approved by the Owner. Each carrier shall have an AM Best Rating of A of better.

F. ARTICLE 11 INSURANCE AND BONDS Article 11.1.1.1 - ADD:

The Contractor shall procure and shall maintain during the life of this Contract, at a minimum, the following insurance for all employees to be engaged in Work for the project under this Contract. In the case Work is sublet, the Contractor shall similarly require Subcontractors to provide the following insurance as well.

Commercial General Liability:
$1,000,000.00 Each Occurrence
$2,000,000.00 General Aggregate Bodily Injury and Property Damage

$2,000,000.00 Products/Completed Operations Aggregate for 2 years following acceptance of Work
$1,000,000.00 Personal and Advertising Injury
$50,000.00 Fire Damage Liability
$5,000.00 Medical Expenses - Shall include premises operations insurance, independent contractor coverage, contractual liability, aggregate limits per project

Automobile Liability:
$1,000,000.00 Bodily Injury and Property Damage, per occurrence
To include coverage for all owner, non-owned and hired automobiles

Umbrella
$1,000,000.00 Aggregate and Each occurrence

Workers' Compensation and Employer's Liability
$1,000,000.00 bodily injury each limit
$1,000,000.00 disease each injury
$1,000,000.00 disease policy limit

G. ARTICLE 11 INSURANCE AND BONDS Article 11.1.1.2 - ADD:

Builders Risk Insurance: The General Contractor shall effect and maintain during the entire period of this project, until Substantial Completion, ALL RISKS Builders Risk Insurance to include as Insured the Owner, the Architect and/or Engineer, the General Contractor, and sub-contractors as their respective interests may appear. This policy shall include but not be limited to the perils of Fire, Lightning, Windstorm, Hurricane, Hail, Explosion, Riot, Civil Commotion, Smoke, Aircraft, Land Vehicles, Vandalism, and Malicious Mischief, etc., in an amount equal to or exceeding 100% of the Contract Sum. Include - Debris Removal, False work and Scaffolding. In the event that it is necessary to operate permanently installed equipment on other than a testing basis or in the event it is necessary for the Owner to occupy a part of the entire structure, the Owner agrees to provide the Risk Insurance Policy as well.

H. ARTICLE 11 INSURANCE AND BONDS Article 11.1.1.3 - ADD:

Proof of Insurance: The contractor shall furnish the Owner with a satisfactory proof of insurance required. Thirty (30) days' notice to Owner and Architect is required prior to cancellation or any major change to insurance therein.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 007300

SECTION 011000 - SUMMARY

PART 1 GENERAL

1.01 PROJECT - Additional Project contact information is specified in Section 000103-Project Directory.

A. Project Name: Gordon ISD Campus Additions and Renovations

B. Owner's Name: Gordon ISD.

C. Architect's Name: HPA.

D. Construction Manager-at-Risk: Pete Durant and Associates (PDA)

E. The project includes a scope of work includes extensive renovation of the Ag classroom building and the existing classroom building, demolition of an existing building plus all work associated with the construction of a new facility complete including: site work, site utilities, grade excavation, earth work, concrete foundation, structure, interior finish out and complete MEP. The new high school portion of this work is a full turn-key construction from the ground up on a portion of the site that has never had any work completed on it. The project will include all normal subcontractors for completing a building. The work will be completed throughout the school year, work around students and the school schedule will be extremely important. The work will have to be completed in phases that include the demolition of the existing elementary building, followed by the new construction of the new high school and completed with the renovation of the existing classroom building. PDA will be responsible for the scheduling of the project.

1.02 CONTRACT DESCRIPTION

A. Contract Type: Construction Manager-at-Risk with Pete Durant and Associates, Inc. (PDA), as described in Document 005000 - Contracting Forms and Supplements

B. DESCRIPTION OF ALTERATIONS WORK
1. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.
2. Scope of alterations work is indicated on drawings.
3. Plumbing: Alter existing system and add new construction, keeping existing in operation.
4. HVAC: Alter existing system and add new construction, keeping existing in operation.
5. Electrical Power and Lighting: Replace existing system with new construction, keeping existing in operation until ready for changeover.
6. Fire Suppression Sprinklers: Provide new sprinkler system for both the existing facility and the new facility..
7. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
8. Telephone and Data: Alter existing system and add new construction, keeping existing in operation.

C. WORK BY OWNER
1. Owner has awarded a contract for Asbestos Abatement which will be completed prior to the beginning of work.

D. OWNER OCCUPANCY

1. Owner intends to continue to occupy portions of the existing building during the entire construction period.
2. Owner intends to occupy the Project upon Substantial Completion.
3. Owner intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal operations.
4. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
5. Schedule the Work to accommodate Owner occupancy.

E. CONTRACTOR USE OF SITE AND PREMISES
1. Construction Operations: Limited to areas indicated on drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   a. Locate and conduct construction activities in ways that will limit disturbance to site, and do not block or damage the adjacent church site or parking.
   b. The site limits shall be determined in pre-work conference with Owner, Architect, and CMaR prior to the commencement of work. Do not extend beyond established parameters.
   c. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is strictly prohibited.
   d. 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.
      2) All employees in direct contact with students must be screened and fingerprinted according to TEA and State mandated regulations.
      3) All contractors' and subcontractors' employees are to have name tag badges at all times.
2. Arrange use of site and premises to allow:
   a. Owner occupancy. Owner will occupy Project site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
      1) Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
      2) Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
      3) Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise, vibration, dust, odors, or other disruption to Owner occupancy with Owner.
         a) Notify Architect and Owner not less than two weeks in advance of proposed utility interruptions.
         b) Obtain Architect's and Owner's written permission before proceeding with utility interruptions.
   b. Work by Owner. 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.

c. Use of site and premises by the public.

3. Provide access to and from site as required by law and by Owner:
   a. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   b. Do not obstruct roadways, sidewalks, or other public ways. Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking of for storage of materials.
      1) Schedule deliveries to minimize use of driveways and entrances by construction operations.
      2) Coordinate deliveries with the CM@R to minimize space and time requirements for storage of materials and equipment on-site.
      3) Construction parking and material storage areas will be coordinated by the CMaR. The location of parking and site access will vary with the progress of construction.
   c. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
   d. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.
   e. Erect dust proof/security temporary partitions to protect the existing building during construction.
4. Work Restrictions:
   a. On-Site Work Hours: Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction
      1) Early morning hours: Unrestricted
      2) Work in existing building: Restricted and quiet hours must be maintained.
      3) Quiet Hours for testing and special activities may be identified and require quiet or no work. CMaR will coordinate these times/days.
      4) Weekend Hours: Unrestricted.
   b. Limit conduct of especially noisy interior or exterior work. Coordinate with Architect and Owner. Consideration of the adjacent property owner - residents would be appreciated as to not interfere with their daily routine.
5. Utility Outages and Shutdown:
   a. Limit disruption of existing utility services to hours the building is unoccupied unless permitted under the following condition and then only after arranging for temporary utility services according to requirements indicated:
      1) Notify Architect and Owner not less than two weeks in advance of proposed utility interruptions.
      2) Obtain Architect's and Owner's written permission before proceeding with utility interruptions.
   b. Limit shutdown of utility services to 2 hours at a time, arranged at least 24 hours in advance with Owner.
   c. Prevent accidental disruption of utility services to other facilities.

F. WORK SEQUENCE
1. Coordinate construction schedule and operations with Architect and Owner. CMaR will keep a very specific schedule to sequence work throughout the site and building for work and structural relevance.

PART 2 BID PACKAGES

2.01 The following Bid Packages have been prepared by PDA . Submit your Proposal by identifying the Bid Package you are submitting for.

A. The Construction Manager has the right to present a Proposal.
1. Each subcontractor and material supplier is hereby advised that PDA Construction could be providing competitive sealed Proposals for some of the various bid packages. PDA Construction could be providing sealed Proposals at the same time and place for public opening and evaluation.
2. The Proposal for each package that presents the best value for the project will be awarded a subcontract or purchase order by PDA Construction, who will perform as a CMaR during the construction.
3. PDA Construction has the option to require performance and payment bonds of any subcontractor he deems appropriate.
4. In addition to any items included on the Bid Form, PDA Construction will provide an Itemized Proposal Package to the Owner at the time of the opening of the Proposals for the following items: Temporary – Construction Fencing; Project Sign; Job Trailer; Porta-Toilets; Daily Cleaning; Final Cleaning; Trash Containment and Disposal; Land Fill Fees; De-watering; Labor and Material for Blocking; Material Only for Thru Wall Flashing; Miscellaneous (not Mechanical – Electrical related); Labor and Material for Backer Rod; Control and Expansion joints.

B. The Bid Packages are as follows:
1. Bid Package # 1 - General Conditions and CM@R Fees will be assigned in this Package.

2. Earth Work
a. Bid Package #2A - Earthwork: The work shall include site clearing, site demolition, under floor excavation, and engineered fill. Drainage fill provided with in 4" of final sub grade elevation at the location as directed and at the time scheduled by the project superintendent.
1) The work shall be as indicated on the Drawings and in Section 311000 and section 31200 of the project manual.
2) The Proposal shall include all surveying work to establish cut and fill and finish grades, as well as locations of building and site elements.
3) The Proposal shall include removal of all waste material not used at other locations on site.
4) Topsoil shall be provided and places as a part of this section.
5) The contractor shall provide engineered fill as indicated on drawings. Engineered fill shall meet requirement in the plans and specifications.

3. Demolition
a. Bid Package #2B: Demolition of the existing elementary school building and interior demolition of the renovates space in the existing classroom building. Demolition to include:
1) Demolition of all spaces as indicated on Drawings for the renovation of the classroom building and the Ag classroom building.
2) Demolition of Elementary classroom building, all utilities, MEP, structure and slab.
3) Demolition of site elements, flat work, fencing and vegetation at the location of the new high school building.

4. Landscaping and Sprinkler System:
   a. Bid Package #2C: Landscaping, Sprinkler System is a complete design-performance package.- Reference Allowances for additional information and scope.
      1) Material and Labor for all specified Vegetation, sod and hydro-mulching.
      2) Material and Labor for complete Sprinkler System.
5. Erosion Control:
   a. Bid Package #2D: Erosion Control
      1) This shall consist of installing all silt fences and erosion control methods as shown on Drawings.
6. Site Utilities:
   a. Bid Package #2E: Site Utilities
      1) The work shall include all Site Utility work as described on Civil Engineering Drawings for all utilities up to within 5' of the new building.
      2) Coordinate work with CM@R and each MEP subcontractor for locations and timing.
      3) Coordinate work with CM@R for schedule and sequencing of work and extensions of drainage from building to detention areas indicated.

7. Division 3 - Concrete:
   a. Bid Package #3A: Concrete to include:
      1) Material and Labor for form work and piers.
      2) Labor for placing concrete and piers Reinforcing Steel.
      3) Material and Labor for Vapor Barrier and Miscellaneous Accessories.
      4) Material and Labor for concrete placement and piers.
      5) The Proposal shall include fine grading of drainage fill, vapor barrier providing placing and finishing of concrete, formwork, setting all inserts and embeds provided by others, and labor to install reinforcing steel.
      6) The final 4" of drainage fill by concrete contractor.
      7) Installation of reinforcing steel in slab and flat work.
      8) The proposer shall include Pavement Joint Sealants.
      9) The proposal shall include all foundation footings, and piers.
      10) The proposal shall include all concrete work associates with Mezzanines and HVAC equipment pads and Relocated Walk-In Freezer mud slab.

8. Division 4 - Masonry:
   a. Bid Package #4A: Masonry to include:
      1) Material and Labor for masonry, brick and CMU and reinforcing steel for reinforced CMU block walls.
      2) Labor for all embeds.
      3) Material and Labor for masonry related thru-wall flashings.
      4) Material and Labor for masonry units, face Brick, and CMU along with all masonry accessories, and all Division 4 specifications.
      5) The Proposal shall include providing concrete fill for Masonry, grout, mortar, flashings, fluid applied water proofing, shoring and templates of false work, lintels and labor for placing all reinforcing steel associated with masonry.
      6) The work shall include labor to install and set all masonry imbedded items, the masonry contractor shall furnish and install fastening systems, anchors and provide welding of any anchors where required.
      7) The work shall include water repellents.

9. Division 5 - Metals: Structural and Miscellaneous Steel Material
   a. Bid Package #5A: Structural Steel to include:
      1) Material for structural steel.

2) Material for Metal Deck.
3) Material for Ships Ladder.
4) Material for Miscellaneous Steel, including but not limited all structural steel trusses, joist, steel deck, miscellaneous steel and metal fabrications, metal stairs, steel ladders, architectural joint systems, pipe bollards and other items indicated on plans and details.
5) The work associated with the structural steel shall be completed in the phases as laid out by the CM@R.
6) The work and Structural steel for the canopy including trusses, joist and miscellaneous steel.

b. Bid Package #5B Steel Erection to include:
1) This package shall include all Labor and equipment for placement of all structural steel and components of all trim, connections and miscellaneous steel including new structural steel for mezzanine, metal ladders pipe bollards and any other steel item indicated on plans.
2) This does not include the pre-engineered metal building package - reference bid package Special construction Division 13.

c. Bid Package #5C - Reinforcing Steel - Materials Only
1) The work shall include all reinforcing steel for masonry reinforced concrete walls, as indicated on drawings, slab and foundations steel, pier steel and any miscellaneous reinforcing steel indicated on drawings.
2) The work shall include labor on-site handling at the time of delivery.
3) Provide all reinforcing steel for all concrete and masonry.

10. Division 6 - Woods, Plastics and Carpentry and Miscellaneous Installations
a. Bid Package #6A Rough Carpentry to include:
1) Material and Labor for Rough Carpentry and Blocking and Plywood Backing.
2) Material and Labor for Finished Carpentry and Hardwood trim.
3) Labor to install Doors - Frames and Hardware.
4) Labor to install Toilet Partitions and Toilet Accessories.
5) Labor to install Signage.
6) Labor to install fire protection specialties (Fire Extinguishers).
7) Labor and Material to install all caulking and sealants, except those performed by window installation and painting.
8) Material and Labor for all temporary facilities, including but not limited to
9) Material and Labor to install Expansion joint covers.
10) Material and Labor to install non-masonry thru wall flashings.
11) Material and Labor to install Fire Stopping, not included in the MEP scope of work.
12) Labor to relocate Existing Exterior Walk-in Freezer Unit (Reference Allowances).
13) Material and Labor to construct and maintain Traffic Control as necessary.

b. Bid Package #6B Architectural Millwork to include:
1) Architectural plastic Laminate casework and millwork - Cabinetry.
2) Material and Labor for upper and lower cabinets and hardware.
3) Material and Labor for solid surface finishes and countertops.
4) Material and Labor for solid surface windowsills and trim work.

11. Division 7 - Thermal and Moisture Protection
a. Bid Package #7A- Metal Panels Framing and Trim for entry canopies over existing doors.
1) Material and Labor to install pre-finished Metal wall panels and trim.
2) Material and Labor to install pre-finished Metal roof panels.
3) Material and Labor for all associated trims and joint sealants.

b. Bid Package #7B- EIFS to include:

1) Material and Labor to install EIFS as shown on drawings.
2) Scaffolding for EIFS installation.

c. Bid Package #7C- Fire-stopping and Fire Proofing to include:
1) Material and Labor to provide patching of the existing sprayed structural steel in the demolition areas with a painted Intumescent paint.

d. Bid Package #7D- Roof Accessories to include:
1) Material and Labor to install roof stairs, roof handrails, roof treads

e. Bid Package #7E- TPO Roofing to include:

f. Materials and Labor to replace existing TPO roofing on existing classroom building, and cut into new roof as necessary for access, expansion joint, new flashings and roof - wall connections as well as MEP and openings as shown on drawings.

12. Division 8 - Openings
a. Bid Package #8A - Doors - Frames and Hardware to include:
1) Material for hollow metal doors and frames.
2) Material for pre-finished wood doors.
3) Material for Hardware, access control, coordination with Fire alarm.
4) Material and Labor for all Door Access control devices.
5) The materials shall be provided as appropriate with the stage of construction and as scheduled by CM@R.
6) Any item may be bid separately, include breakdown for each section.

b. Bid Package # 8B Overhead Coiling Doors to include:
1) Material and Labor for Overhead Coiling Doors- Coordinated with Kitchen Equipment installation.

c. Bid Package #8C - Glass and Glazing to include:
1) Material and Labor for Aluminum Store Front Doors and associated Hardware and Aluminum Windows.
2) Material and Labor for Glazing, including Vision Panels, borrowed lites and interior glazed windows.
3) Material and Labor for installing Full Size Toilet Room Mirrors.
4) The Proposal shall include caulking and sealants associated with this work.

13. Division 9 - Finishes
a. Bid Package # 9A - Drywall and Ceilings to include:
1) Material and Labor for interior and exterior Light Gage Metal Stud Framing.
2) Material and Labor for interior and exterior Structural Metal Stud Framing.
3) Material and Labor for Gypsum Wall Board.
4) Material and Labor for Exterior Sheathing.
5) Material and Labor for Cement Backer Board.
6) Material and Labor for Hard and Lay-In Ceilings.
7) Material and Labor for wall and above ceiling insulation.
8) Material and Labor for ceiling insulation above Lay-In Ceilings.
9) Material and Labor for installing insulation in walls.
10) Taping and bedding shall be included in painting.

b. Bid Package #9B - Resilient Flooring to include:
1) Material and Labor for Resilient (MVT) Floor Covering, Base and Accessories.
2) Material and Labor for Tile Carpeting.

c. Bid Package #9C - Painting to include:
1) Material and Labor for Interior Painting.
2) Material and Labor for Exterior Painting.
3) Material and Labor for Cabinetry Staining and Sealing.
4) Material and Labor for Hardwood Staining and Sealing.
5) The work shall include the taping, bedding and texturing of all drywall.

d. Bid Package #9D - Tiling
    1) The work shall include Ceramic Floor and Wall tile, associated trim, corners and caps; floor prep and leveling, floor latex bond coat and crack suppression membrane if required.
    2) The work shall be as indicated on the drawings and in the Project Manual including Ceramic Tile, and Finish Schedule and Key.

14. Division 10 - Accessories - Material Only
    a. Bid Package #10A - Accessories to include: Material ONLY
        1) (Labor to install these items is included in Rough Carpentry Bid Package # 6A).
        2) Material for Signage.
        3) Material for Plastic Toilet Compartments.
        4) Material for Toilet and Bath Accessories.
        5) Material for Fire Protection Specialties.
        6) Materials to be provided as appropriate with the stage of construction and as scheduled by the CM@R.
        7) Any individual item may be bid separately Include breakdown for each section.
    b. Bid Package #10B - Lockers
        1) Material and Labor to provide and install Lockers as specified and indicated on drawings.
        2) The work shall include all materials, labor and installation of lockers.

15. Division 11 - Equipment
    a. Bid Package #11 A - Food Service Equipment
        1) Labor and Material for all specified Food Service equipment.
        2) Work to include final installation, coordination of rough-in for all equipment.
        3) Work to include final set-up and training on all equipment.
    b. Bid Package #11B - Science Equipment
        1) Labor and Material for all specified Science Equipment and accessories.
        2) Work to include final installation, coordination of rough-in for all equipment.
        3) Work to include final set-up and training on all equipment.

16. Division 12- Furnishings - Window Treatment
    a. Bid Package #12A - Horizontal Window Blinds:
        1) Material and Labor to provide for all horizontal window blinds as specified for all office windows, interior and exterior, and Teller windows - not to include windows for store front windows associated with main lobby.

17. Division 13 - Special Construction
    a. Bid Package #13A - Pre-Engineered Metal Building
        1) Material and Labor for All Metal Building Systems work as indicated on the drawings and in Specification Section 133419 of the project manual.
        2) The work shall include all temporary shoring of the existing structure during foundation work, this includes all materials and equipment necessary to complete the work.
        3) The work shall include all components for a weather tight finish for the standing seam roof as indicated in the drawings and project manual.

4) The work shall include the provisions of all system components including, but not limited to anchor bolts, rigid frames, steel wall girts and purlins, portal frames, eave struts, metal panels (exterior wall and roof interior lines and soffits), vinyl faced roof and wall insulation - including clips and thermal blocks, miscellaneous steel framing (bracing rods, framing for MEP items, openings etc.) and all associated trim and accessories (gutters, downspouts, rake trim, ridge covers, panel base trim, corner trim, panel closures etc.).

18. Division 22 - Plumbing
    a. Bid Package #22A - Plumbing to include:
        1) Labor and Material for extending Refrigerant lines for relocating Existing Walk-In Freezer Unit - Reference Allowances.
        2) Material and Labor for Domestic Water Piping.
        3) Material and Labor for Sanitary Sewer Piping.
        4) Material and Labor for Natural Gas Piping.
        5) Material and Labor for connection to Storm Drainage Piping - coordinate with Site Utilities.
        6) Material and Labor for Piping Insulation.
        7) Material and Labor for Water Heaters.
        8) Material and Labor for Plumbing Fixtures.
        9) The proposal shall include providing the fire caulking of all penetrations through fire-rated partitions.
        10) The work shall include color coding and identification of piping and valves on the Mechanical systems and equipment.
        11) The work shall include labor and materials for the installation of condensate drain piping as indicated for Mechanical Equipment.
        12) Provide all Utility Extensions and connections their main connections shall be included.
        13) Provide sinks and coordination of installation with cabinetry sub-contractor.
    b. Bid Package #22B - Fire Suppression Sprinkler System to include:
        1) Reference Unit cost for new 6" line to be coordinated with sprinkler system for location and connection for new sprinkler riser.
        2) Labor and Material to install a Complete Sprinkler system to all areas required including mezzanine spaces and canopies.

19. Division 23 - HVAC
    a. A. Bid Package #23A - HVAC to include:
        1) The work shall include all HVAC controls, including conduit and conductor as well as providing installation and connection of control devices.
        2) Material and Labor for Ducting.
        3) Material and Labor for Duct Insulation.
        4) Material and Labor for Refrigerant Piping.
        5) Coordination of connection of Condensate Piping.
        6) Material and Labor for HVAC Piping Insulation.
        7) Material and Labor for HVAC Equipment.
        8) Architectural Louvers as scheduled.
        9) The work shall include fire caulking of all penetrations through fire rated partitions for HVAC work.

20. Division 26 - Electrical
    a. A. Bid Package #26A - Electrical to include:
        1) The proposal shall include providing fire caulking for all penetrations of fire rate penetrations and assemblies.

2) Material and Labor for Electrical, Fire Alarm, Data and Low Voltage Raceways.
3) Material and Labor for Electrical Wiring.
4) Material and Labor for Electrical Gear.
5) Material and Labor for Light Fixtures.
6) Labor and Material for powering the relocated Walk-in Freezer unit (Reference Allowances).
7) The work shall include the cost of installation of temporary electrical service, power and lighting , as well as the removal of all temporary electrical as the project completes.
8) The proposal is to include all computer and data wiring, conduit and boxes and devices as shown on the drawings and specifications.
9) Coordinate with Fire Alarm with Door Hardware and access control and Video Surveillance.

21. Division 28 - Electronic Safety and Security
    a. Bid Package #28A- Fire Alarm System
        1) The work shall include labor and material to provide specified digital, Addressable Fire alarm system with Voice Evacuation. As specified in Project Manual section 283111.
        2) The work shall be coordinated with Electrical and Door Hardware and access control and Video Surveillance.
    b. Bid Package #28B - Video Surveillance
        1) The work shall include labor and material to provide specified Digital Video Surveillance system as specified in Project Manual Section 282313.
        2) The work shall be coordinated with Electrical.

22. Division 31 - Termite Control
    a. Bid Package #31 - Termite Control
        1) Material and Labor to provide Termite Control treatment under slab.

PART 3 EXECUTION - NOT USED

END OF SECTION 011000

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Correlation of CMaR submittals based on changes.

D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 005000 - Contracting Forms and Supplements: Forms to be used.

B. Section 007200 - General Conditions and Document 007300 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

C. Section 017800 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section.

F. Revise schedule to list approved Change Orders with each Application for Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: 30 days- Monthly.

B. Use Form AIA G702 and Form AIA G703.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.

5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

I. Submit one electronic copy of each Application for Payment.

J. Include the following with the application:
1. Partial release of liens from major subcontractors and vendors.
2. Affidavits attesting to off-site stored products.

K. When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to CMaR.

B. For other required changes, Architect will issue a document signed by Owner instructing CMaR to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change . CMaR shall prepare and submit a fixed price quotation.

D. CMaR may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on CMaR's price quotation.
2. For change requested by CMaR, the amount will be based on the CMaR's request for a Change Order as approved by Architect and Owner.
3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.

F. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide the following data:
a. Quantities of products, labor, and equipment.
b. Insurance, and bonds.

c. Overhead and profit.
d. Justification for any change in Contract Time.
e. Credit for deletions from Contract, similarly documented.

2. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012000

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SECTION 012100 - ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Owner's Contingency allowance.

C. Payment and modification procedures relating to allowances.

1.02 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to CMaR or subcontractor, less applicable trade discounts, including delivery, handling, and instillation of materials. .

B. Architect Responsibilities:
1. Consult with Owner and CMaR for consideration and selection of products, suppliers, and installers.

C. CMaR Responsibilities:
1. Assist Architect in selection of products, suppliers, and installers.
2. Obtain proposals from suppliers and installers and offer recommendations.
3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

D. Differences in costs will be adjusted by Change Order.

1.03 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

B. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Include the stipulated sum of $12,000 for Relocation and reinstallation of existing walk-in freezer. The mud slab for temporary installation is to be included in the concrete bid package, this allowance includes the miscellaneous carpentry to move the existing unit and the MEP for re-connection.

B. Include the stipulated sum of $10,000 for purchase, delivery and installation a back lighted building sign and logo at one location.

C. Include the stipulated sum of $5,000 for purchase, delivery and installation of Koroseal wall murals as indicated on the floor plan. Allowance is to include artwork, wall covering and liquid lamination protective coating.

D. Include the stipulated sum of $50,000.00 for purchase, delivery, and installation of landscaping and lawn sprinkler system. This allowance would include hydro mulching back around the building against the new work, turfing as necessary at the front door and entry area to establish lawn area, limited shrubbery and a lawn sprinkler system to maintain the landscaping provided.

E. Owner's Contingency Allowance: Include the stipulated sum of $100,000 for use upon Owner's and Architect's instructions.

F. Contractor's Contingency Allowance: Include the stipulated sum of $300,000 for Contractor's use with Owner approval.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Assist by providing necessary equipment, workers, and survey personnel as required.

C. Measurement by Area: Measured by square dimension using mean length and width or radius.

D. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

1.05 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

1.06 SCHEDULE OF UNIT PRICES

A. Item: Painting; Section 099000.
   1. Provide a unit price for paint preparation and application of coats as specified.
   2. Unit of measurement: Square Foot.

B. Item: Concrete Paving; Section 033000.
   1. Install new 6” thick concrete paving on existing subgrade. Prepare the subgrade as specified in the Civil Drawings and compact as necessary. Provide reinforcing steel, control joints, and contraction joints as indicated on the Civil Drawings.
   2. Unit of Measurement: Square Foot.

C. Item: Concrete Curb and Gutter; Section 033000.
   1. Prepare all subgrade and grade including any cut and fill required to install nominal 24” wide and 6” deep flow line conventional curb and gutter as indicated on the Civil Drawings. Reinforcement, expansion joints and control joints shall be as indicated on the Civil Drawings.
   2. Unit of Measurement: Linear Foot.

D. Item: Concrete Sidewalk; Section 033000.
   1. Install new 4” thick concrete sidewalk on existing subgrade. Prepare the subgrade as specified in the Civil Drawings and compact as necessary. Provide reinforcing steel, control joints, and contraction joints as indicated on the Civil Drawings.
   2. Unit of Measurement: Square Foot.

E. Item: 6" Water Line; Division 31
   1. Install new 6" water line to connect the existing main to the new fire sprinkler service to new building. The new line would be approximately 150', it would come from the north side of Austin Street, crossing the street (asphalt) and back west to the Fire Riser Room as shown on plans. The work would include the 6" pipeline, cutting the street, preparing the subgrade and back filling according to specifications on the Civil Drawings and compaction as necessary. The location and depth of the existing line is not certain at this time.
   2. Unit of Measure: Linear Foot.

F. Item: Main Domestic Water 4" Line: Division 31
   1. Install new 4" domestic water line to connect to the existing main west of the elementary school building - in the abandoned alley way between the gymnasium and classroom building. The new line would be approximately 90' from connection to the entry point for the new high school building. The work would include the 4" pipeline, preparing the subgrade and back filling according to specifications on the Civil Drawings, and compaction as necessary. The location and depth of the existing line is not certain at this time.
   2. Unit of Measure: Linear Foot.

G. Item: Drilled Piers
   1. Drilled Piers to include concrete reinforcing as detailed in the Structural Drawings. The structural Engineering drawings have indicated a standard depth. This Unit price is per Linear Foot of additional or reduced length if required. A log of all pier depth is to be maintained and balanced at the completion of pier drilling, the additions and reductions shall be recorded and accounted for in Linear Feet for each size of pier indicated on the foundation plan.
   2. Unit of Measure: Linear Foot (Addition or Reduction)

H. Item: Pier Casing

1. Steel Casing for Drilled Piers shall be provided for each size of pier as indicated on the foundation plan. The Structural Engineer has indicated a standard depth of piers required. The geotechnical testing has shown water was encountered during drilling, but not certain that casings will be required. Verify with the Architect and Materials Testing agency that a casing is required before moving forward with the use of the casing. A log of all pier casing length is to be maintained and totaled at the completion of pier drilling for each size of pier casing utilized as indicated on the foundation plan.
2. Unit of Measure: Linear Foot

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012200

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SECTION 012300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 RELATED REQUIREMENTS

A. Document 002113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

1.03 ACCEPTANCE OF ALTERNATES

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

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

1.04 SCHEDULE OF ALTERNATES - Reference Drawings for Descriptions

A. Alternate No. 1 - Corridor Walls Tile Wainscot
   1. Alternate: Reference ceramic tile Section 093000 - This alternate would provide a credit to deduct the 6' high wainscot in all corridors and provide vandal resistant gypsum board in all corridors along with 4" tall rubber base on all walls. Base bid price includes 6' high tile wainscot in all corridors with tile base.

B. Alternate No. 2 - Toilet Room Ceramic Tile Wainscot
   1. Alternate: Reference ceramic tile Section 093000 - this alternate would deduct the full height ceramic tile from 3 walls to a 6' wainscot. The toilet fixture wall would remain full height. This alternate would maintain accent tile as specified on all walls. The base bid for all toilet rooms is full height all walls.

C. Alternate No. 3 - North Parking along Austin Street
   1. Alternate: Reference Civil Engineering Drawings - this alternate would include all site work, grading, concrete, flat work, curb & gutter, striping, signage and reinforcing to provide parking along Austin Street. Base bid for civil work would end after the sidewalk on the north side of the new building, but including any grading necessary to match existing grade.

D. Alternate No. 4 - Pendant & Decorative Linear Lighting Package option
   1. Alternate: This alternate would include a deduction in the lighting package to replace the decorative pendant lights and linear strip specified around the ceiling clouds with a standard specified 2 X 2 lay in LED light fixture in the cloud where the LED can type lights are shown.

E. Alternate No. 5 - Voluntary Lighting Package
   1. Alternate: This alternate would include a voluntary deduct to change the lighting package from the specified lights to a equal but alternate manufacturer / distributor for all of the lights specified.

F. Alternate No. 6 - New TPO Roof on Elementary Facility
   1. Alternate: This alternate would include all work associated with providing a new TPO type roof system, as specified in the project manual on existing roof structure and decking to remain. Work in this alternate would include replacing all pre finished metal coping, gutters and downspout where they occur, and all required flashings and components associated with new and existing roof curb and other penetrations to occur during the renovation of the existing facility. Reference Roof plans and MEP drawings for additional details. Base Bid price will include patching of existing TPO type roof system to accommodate new roof mounted equipment and penetrations.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 002113 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by CMaR to materials, products, assemblies, and equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

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

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal:
   1. Submit substitution requests by using the information and instructions provided in the section.

B. Architect will consider requests for substitutions after date of Agreement.

C. Substitutions will not be considered under one or more of the following circumstances:
   1. When acceptance will require revisions to Contract Documents.

3.03 RESOLUTION

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

B. Architect will notify CMaR in writing of decision to accept or reject request.

END OF SECTION 012500

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal.

C. Preconstruction meeting.

D. Progress meetings.

E. Progress photographs.

F. Coordination drawings.

G. Submittals for review, information, and project closeout.

H. Number of copies of submittals.

I. Requests for Information (RFI) procedures.

J. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: General product requirements.

B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

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

1.04 PROJECT COORDINATOR

A. Project Coordinator: Construction Manager at Risk (CMaR).

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for building access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 011000 - Summary.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document.
1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g., supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, CMaR's correction punch list, and any other document any participant wishes to make part of the project record.
2. It is CMaR's responsibility to submit documents in allowable format.
3. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.02 PRECONSTRUCTION MEETING

A. Project Coordinator will schedule a meeting after Notice of Award.

B. Attendance Required:

1. Owner.
2. Architect.
3. CMaR.
4. All Subcontractors..

C. Agenda:
1. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
2. Submission of initial Submittal schedule.
3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
4. Scheduling.

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

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at minimum bi-monthly intervals.

B. CM@R Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. CMaR.
2. Owner.
3. Architect.
4. CMaR's superintendent.
5. Major subcontractors.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Other business relating to work.

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

3.04 PROGRESS PHOTOGRAPHS

A. Maintain one set of all photographs at project site for reference; identified with date.

B. Photography Type: Digital; electronic files.

C. In addition to periodic, recurring views, take photographs of each of the following events:
1. Completion of site clearing.
2. Excavations in progress.

3. Foundations in progress and upon completion.
4. Structural framing in progress and upon completion.
5. Enclosure of building, upon completion.
6. Final completion, minimum of ten (10) photos.

D. Take photographs as evidence of existing project conditions as follows:
1. Interior views.
2. Non-construction areas that will be utilized for passage, storage, etc.
3. Exterior views.

E. Views:
1. Consult with Architect for instructions on views required.
2. Provide factual presentation.
3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
2. File Naming: Include project identification and date.

3.05 AS-BUILT DRAWINGS

A. Provide information required by Project Coordinator for preparation of As-Built drawings.

B. Review drawings prior to submission to Architect.

3.06 REQUESTS FOR INFORMATION (RFI)

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

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

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.

E. Content: Include information necessary to provide an actionable response.
1. Official Project name and number, and description.
2. Owner's, Architect's, and CMaR's names.

3. Consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. CMaR's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

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

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.

H. Review Time: Architect will respond and return RFIs to CMaR within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 3:00 PM will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in CMaR's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
3. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.07 SUBMITTALS FOR REVIEW

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

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

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

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.08 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Certificates.
   2. Test reports.
   3. Inspection reports.
   4. Manufacturer's instructions.
   5. Manufacturer's field reports.
   6. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

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

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. Retained samples will not be returned to CMaR unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   2. Transmit using approved form.
      a. Use CMaR's form, subject to prior approval by Architect.
   3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   4. Identify: Project; CMaR; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   5. Apply CMaR's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the CMaR, or without CMaR's stamp will not be acknowledged, reviewed, or returned.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.

a. For each submittal for review, allow 15 days excluding delivery time to and from the CMaR.
b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.

7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for CMaR and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
1. Collect required information into a single submittal.
2. Submit concurrently with related shop drawing submittal.

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

D. Samples Procedures:
1. Transmit related items together as single package.

3.12 SUBMITTAL REVIEW

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

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
1) At CMaR's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2. Not Authorizing fabrication, delivery, and installation:
a. "Revise and Resubmit".
1) Resubmit revised item, with review notations acknowledged and incorporated.

b. "Rejected".
   1) Submit item complying with requirements of Contract Documents.

END OF SECTION 013000

SECTION 013553 - SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security measures including entry control, personnel identification, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: use of premises and occupancy.

1.03 SECURITY PROGRAM

A. Protect Work , existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

1.04 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

1.05 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number and employer.

C. Require return of badges at expiration of their employment on the Work.

D. Prime employees that will come in contact with the students will require a full background check including finger printing or proof of a recent background check - in accordance with Texas Education Agency requirements see specific requirements below.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 013553

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals

B. Quality assurance.

C. References and standards.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

B. Section 014219 - Reference Standards.

C. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022.

C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

1.04 DEFINITIONS

A. CMaR's Quality Control Plan: CMaR's management plan for executing the Contract for Construction.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Test Reports: After each test/inspection, promptly submit one copy of report to Architect and to CMaR.
   1. Include:
      a. Date issued.
      b. Project title and number.

c. Name of inspector.
d. Date and time of sampling or inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and CMaR or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.06 Quality Assurance

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of CMaR by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Texas.

B. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.07 REFERENCES AND STANDARDS - See Section 014219

1.08 Testing and Inspection Agencies and Services

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

B. Owner's employment of agency in no way relieves CMaR of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 MOCK-UPS

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

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

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

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

E. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

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

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

3.03 TOLERANCES

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

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

3.04 TESTING AND INSPECTION

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

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

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of CMaR.

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

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

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

3.05 MANUFACTURERS' FIELD SERVICES

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

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

3.06 DEFECT ASSESSMENT

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

B. If, in the opinion of Architect or Owner, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 014000

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SECTION 014219 - REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

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

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

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

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AA -- ALUMINUM ASSOCIATION, INC.

A. AA DAF-45 - Designation System for Aluminum Finishes 2003 (Reaffirmed 2009).

2.02 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.

B. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products 2021.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020, with Errata (2022).

F. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

2.03 AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

A. AASHTO M 237 - Standard Specification for Epoxy Resin Adhesives for Bonding Traffic Markers to Hardened Portland Cement and Asphalt Concrete 2005 (Reapproved 2019).

2.04 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

A. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete 1998 (Reapproved 2004).

B. ACI 301 - Specifications for Concrete Construction 2020.

C. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

D. ACI 303R - Guide to Cast-in-Place Architectural Concrete Practice 2012.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

F. ACI 305R - Guide to Hot Weather Concreting 2020.

G. ACI 306R - Guide to Cold Weather Concreting 2016.

H. ACI 308R - Guide to External Curing of Concrete 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).

J. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).

K. ACI SP-66 - ACI Detailing Manual 2004.

2.05 AGC -- ASSOCIATED GENERAL CONTRACTORS OF AMERICA

A. AGC (CPSM) - Construction Planning and Scheduling Manual 2004.

2.06 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.

B. AHRI 365 (I-P) - Performance Rating of Commercial and Industrial Unitary Air-Conditioning Condensing Units 2009.

2.07 AIA -- THE AMERICAN INSTITUTE OF ARCHITECTS

A. AIA A133 - Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price 2019.

B. AIA A201 - General Conditions of the Contract for Construction 2017.

C. AIA A701 - Instructions to Bidders 2018.

D. AIA G701 - Change Order 2017.

E. AIA G702 - Application and Certificate for Payment 1992.

F. AIA G703 - Continuation Sheet 1992.

G. AIA G704 - Certificate of Substantial Completion 2017.

H. AIA G706A - Contractor’s Affidavit of Release of Liens 1994.

I. AIA G707 - Consent of Surety to Final Payment 1994.

2.08 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

A. AISC (MAN) - Steel Construction Manual 2017.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

2.09 AISI -- AMERICAN IRON AND STEEL INSTITUTE

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2018).

B. AISI S220 - North American Standard for Cold-Formed Steel Framing - Nonstructural Members 2015.

2.10 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.

D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).

E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.

F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).

N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.

O. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar 2019.

P. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2021.

Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.

R. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation 1999 (Reaffirmed 2021).

S. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2019.

T. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.

U. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.

V. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).

W. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).

X. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2019.

Y. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile 2020.

Z. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2021.

AA. ANSI/BHMA A156.29 - Standard for Exit Locks, Exit Alarms, Alarms for Exit Devices 2017.

BB. ANSI A250.3 - American National Standard Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames. 2007 (R2011).

CC. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames. 2003.

DD. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames. 1998 (R2011).

EE. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2019.

FF. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.

GG. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2020.

HH. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

II. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

JJ. ANSI C37.50 - American National Standard for Switchgear - Low Voltage AC Power Circuit Breakers Used In Enclosures - Test Procedures 2018.

KK. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.

LL. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

MM. ANSI Z400.1/Z129.1 - American National Standard for Hazardous Workplace Chemicals – Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation 2010.

2.11 ASA -- ACOUSTICAL SOCIETY OF AMERICA

2.12 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

A. ASHRAE (FUND)-2017 - ASHRAE Handbook - Fundamentals 2017.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE Std 126 - Method of Testing HVAC Air Ducts 2020.

2.13 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

B. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.

C. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2017, with Errata.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.

2.14 ASTM A Series -- ASTM INTERNATIONAL

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2021.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

D. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

G. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).

H. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

I. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

K. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.

L. ASTM A370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products 2021.

M. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

N. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

O. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

P. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing 2021.

Q. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods 2021.

R. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel 2021, with Editorial Revision.

S. ASTM A611 - Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled; 1997.

T. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

U. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

V. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

W. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement 2016.

X. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

Y. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2020.

Z. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

AA. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

2.15 ASTM B Series -- ASTM INTERNATIONAL

A. ASTM B32 - Standard Specification for Solder Metal 2020.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

D. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

2.16 ASTM C Series -- ASTM INTERNATIONAL

A. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field 2021a.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

C. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

D. ASTM C55 - Standard Specification for Concrete Building Brick 2017.

E. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2021b.

F. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.

G. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

H. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

I. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete 2017.

J. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

K. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2022.

L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

M. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.

N. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

O. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.

P. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.

Q. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).

R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.

S. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board 2004 (Reapproved 2020).

T. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

U. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

V. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.

W. ASTM C630/C630M - Standard Specification for Water-Resistant Gypsum Backing Board; 2000.

X. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

Y. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).

Z. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

AA. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing 2017.

BB. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

CC. ASTM C834 - Standard Specification for Latex Sealants 2017.

DD. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

EE. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring 2003 (Reapproved 2018).

FF. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

GG. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.

HH. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

II. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2018.

JJ. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.

KK. ASTM C1036 - Standard Specification for Flat Glass 2021.

LL. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

MM. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

NN. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

OO. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022.

PP. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.

QQ. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

RR. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.

SS. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets 2017.

TT. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

UU. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

VV. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

WW. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).

XX. ASTM C1670/C1670M - Standard Specification for Adhered Manufactured Stone Masonry Veneer Units 2021b.

YY. ASTM C1780 - Standard Practice for Installation Methods for Cement-Cased Adhered Masonry Veneer 2020.

2.17 ASTM D Series -- ASTM INTERNATIONAL

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method 2015, with Editorial Revision (2016).

C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)) 2012 (Reapproved 2021).

D. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).

H. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

I. ASTM D2940/D2940M - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports 2020.

J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

K. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.

L. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser 2019.

M. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils 2017, with Editorial Revision (2018).

N. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus 2021.

O. ASTM D6637/D6637M - Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method 2015.

P. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2017a, with Editorial Revision (2021).

2.18 ASTM E Series -- ASTM INTERNATIONAL

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.

F. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a (Reapproved 2019).

G. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.

H. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

I. ASTM E413 - Classification for Rating Sound Insulation 2022.

J. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

K. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).

L. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

M. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

N. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.

O. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

P. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.

Q. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

R. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

S. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.

T. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs 2017.

U. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

V. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

W. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.

X. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).

2.19 ASTM F Series -- ASTM INTERNATIONAL

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).

C. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor 2020.

D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.

E. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

F. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).

G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.

2.20 ASTM G Series -- ASTM INTERNATIONAL

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

2.21 AWI -- ARCHITECTURAL WOODWORK INSTITUTE

A. AWI P-211 - Source Book; current edition.

B. AWI (QCP) - Quality Certification Program Current Edition.

2.22 AWI/AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK INSTITUTE/ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

2.23 AWS -- AMERICAN WELDING SOCIETY

A. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

B. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

D. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).

E. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

2.24 BHMA -- BUILDERS HARDWARE MANUFACTURERS ASSOCIATION

A. BHMA (CPD) - Certified Products Directory Current Edition.

B. BHMA A156.9 - Cabinet Hardware 2020.

C. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.

D. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.

2.25 CDA -- COPPER DEVELOPMENT ASSOCIATION, INC.

A. CDA A4050 - Copper in Architecture - Handbook current edition.

2.26 CISCA -- CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION

A. CISCA (AC) - Acoustical Ceilings: Use and Practice 1999.

2.27 CRI -- CARPET AND RUG INSTITUTE

A. CRI 104 - Standard for Installation of Commercial Carpet 2015.

2.28 CRSI -- CONCRETE REINFORCING STEEL INSTITUTE

A. CRSI (DA1) - CRSI Design Handbook 2008.

B. CRSI (DA4) - Manual of Standard Practice 2009.

C. CRSI (P1) - Placing Reinforcing Bars 2011.

2.29 DHI -- DOOR AND HARDWARE INSTITUTE

2.30 FM -- FACTORY MUTUAL GLOBAL

A. FM (AG) - FM Approval Guide current edition.

2.31 GA -- GYPSUM ASSOCIATION

A. GA-201 - Using Gypsum Board for Walls & Ceilings; 1990.

B. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

C. GA-226 - Application of Gypsum Board to Form Curved Surfaces 2019.

D. GA-600 - Fire Resistance Design Manual Sound Control 2021.

2.32 GANA -- GLASS ASSOCIATION OF NORTH AMERICA

A. GANA (GM) - GANA Glazing Manual 2008.

B. GANA (SM) - GANA Sealant Manual 2008.

2.33 HPVA -- HARDWOOD PLYWOOD VENEER ASSOCIATION

A. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

2.34 IAS -- INTERNATIONAL ACCREDITATION SERVICE

A. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

2.35 ICC -- INTERNATIONAL CODE COUNCIL, INC.

A. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

B. ICC (IBC)-2015 - International Building Code 2015.

C. ICC (IECC)-2015 - International Energy Conservation Code 2015.

D. ICC (IFC)-2015 - International Fire Code 2015.

E. ICC (IFGC)-2015 - International Fuel Gas Code 2015.

F. ICC (IMC)-2015 - International Mechanical Code 2015.

G. ICC (IPMC)-2015 - International Property Maintenance Code 2015.

2.36 ICC-ES -- ICC EVALUATION SERVICE, INC.

A. ICC-ES AC51 - Acceptance Criteria for Precast Stone Veneer 2016.

2.37 ICRI -- INTERNATIONAL CONCRETE REPAIR INSTITUTE

A. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

2.38 IGMA -- INSULATING GLASS MANUFACTURERS ALLIANCE

A. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

2.39 ISFA - INTERNATIONAL SURFACE FABRICATORS ASSOCIATION

A. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.

2.40 ITS -- INTERTEK TESTING SERVICES NA, INC.

A. ITS (DIR) - Directory of Listed Products current edition.

2.41 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

A. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames 2012.

B. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

C. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

D. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.

E. NAAMM HMMA 850 - Fire-Rated Hollow Metal Doors and Frames 2014.

F. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames 2018.

G. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

H. NAAMM AMP 510 - Metal Stairs Manual 1992.

2.42 NCMA -- NATIONAL CONCRETE MASONRY ASSOCIATION

A. MVMA (AMSV) - Installation Guide and Detailing Options for Compliance with ASTM C1780 for Adhered Manufactured Stone Veneer 2021.

B. NCMA TEK 20-01 - Key Installation Checkpoints for Manufactured Stone Veneer 2014.

2.43 NECA -- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

A. NECA (INST) - NECA Standard of Installation; 1993.

2.44 NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

A. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

2.45 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

A. NFPA 1 - Fire Code 2021, with Amendment (2020).

B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

C. NFPA 30 - Flammable and Combustible Liquids Code 2021, with Amendment (2020).

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

E. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022.

G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

I. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.

2.46 NFRC -- NATIONAL FENESTRATION RATING COUNCIL, INC.

A. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.

B. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.

C. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2020.

2.47 NSF -- NSF INTERNATIONAL (THE PUBLIC HEALTH AND SAFETY ORGANIZATION)

A. NSF 2 - Food Equipment 2021.

2.48 NWWDA -- NATIONAL WOOD WINDOW AND DOOR ASSOCIATION (name changed to WDMA)

2.49 PDCA -- PAINTING AND DECORATING CONTRACTORS OF AMERICA

A. PDCA (MAN) - Architectural Specification Manual; 1986.

2.50 RFCI -- RESILIENT FLOOR COVERING INSTITUTE

A. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

2.51 SCAQMD -- SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

A. SCAQMD 1113 - Architectural Coatings 1977, with Amendment (2016).

B. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2017).

2.52 SDI -- STEEL DOOR INSTITUTE

A. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

2.53 SJI -- STEEL JOIST INSTITUTE

A. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders 2020.

2.54 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

A. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

B. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.

2.55 SPIB -- SOUTHERN PINE INSPECTION BUREAU, INC.

A. SPIB (GR) - Grading Rules 2014.

2.56 SSPC -- SOCIETY FOR PROTECTIVE COATINGS

A. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

B. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

C. SSPC-SP 2 - Hand Tool Cleaning 2018.

D. SSPC-SP 3 - Power Tool Cleaning 2018.

2.57 TCNA -- TILE COUNCIL OF NORTH AMERICA, INC.

A. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2021.

2.58 TMS -- THE MASONRY SOCIETY

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

2.59 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (DIR) - Online Certifications Directory Current Edition.

B. UL (FRD) - Fire Resistance Directory Current Edition.

C. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

D. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.

E. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

2.60 WCMA -- WINDOW COVERING MANUFACTURERS ASSOCIATION

A. WCMA A100.1 - Safety of Window Covering Products 2018.

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.01 CFR -- CODE OF FEDERAL REGULATIONS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

C. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

D. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

3.02 EPA -- ENVIRONMENTAL PROTECTION AGENCY

3.03 FDA -- FOOD AND DRUG ADMINISTRATION

A. FDA Food Code - Chapter 6 - Physical Facilities Current Edition.

3.04 PS -- PRODUCT STANDARDS

A. PS 1 - Structural Plywood 2009 (Revised 2019).

B. PS 20 - American Softwood Lumber Standard 2021.

3.05 USC -- UNITED STATES CODE

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

END OF SECTION 014219

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing & temporary walkways

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 013553 - Security Procedures

B. Section 015100 - Temporary Utilities.

1.03 REFERENCE STANDARDS

1.04 TEMPORARY UTILITIES - See Section 015100

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing toilet facilities outside of the work area may not be used.

C. New permanent toilet facilities may not be used.

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

1.05 TEMPORARY SANITARY FACILITIES

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

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and adjacent properties from damage from construction operations and demolition.

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

C. Traffic Controls: around bus delivery & pickup of students, Coordinate any work around or approaching state highway to the east of the building and approaches and permitting required for connection to new drive.

1.07 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 EXTERIOR ENCLOSURES

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

1.09 INTERIOR ENCLOSURES

A. Provide temporary partitions where needed to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 SECURITY - See Section 013553

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

B. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING

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

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

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

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

E. Existing on-site roads may not be used for construction traffic. Do not park in the teaching staff parking areas.

F. Do not allow construction vehicle parking on or blocking adjacent neighborhood driveways.

1.12 WASTE REMOVAL

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

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

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

1.13 FIELD OFFICES

A. Office: Weathertight, with lighting and electrical.

B. Contractor is to provide space for Project meetings, with table and chairs to accommodate 6 persons.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.

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

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

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

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

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

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

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

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.04 QUALITY ASSURANCE

A. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
   1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

C. Where other criteria are met, CMaR shall give preference to products that:
   1. If used on interior, have lower emissions.
   2. If wet-applied, have lower VOC content.

2.02 PRODUCT OPTIONS

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

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

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

2.03 MAINTENANCE MATERIALS

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

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

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

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

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

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

H. Provide off-site storage and protection when site does not permit on-site storage or protection.

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

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

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

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

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

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

END OF SECTION 016000

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SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

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

I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 013000 - Administrative Requirements: Submittals procedures.

C. Section 014000 - Quality Requirements: Testing and inspection procedures.

D. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

E. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.

5. Work of Owner or separate Contractor.

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in Texas and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

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

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

1.06 COORDINATION

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

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

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

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

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

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

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

B. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 PREINSTALLATION MEETINGS

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

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

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

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

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

3.04 LAYING OUT THE WORK

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

B. Promptly notify Architect of any discrepancies discovered.

C. Periodically verify layouts by same means.

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

3.05 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

3.06 CUTTING AND PATCHING

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

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

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

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

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

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

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

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

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

3.07 PROGRESS CLEANING

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

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

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

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

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.09 SYSTEM STARTUP

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

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

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

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

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

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

3.10 DEMONSTRATION AND INSTRUCTION

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

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

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

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

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

3.11 ADJUSTING

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

3.12 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

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

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

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

F. Clean filters of operating equipment.

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

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

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

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the CMaR's Correction Punch List for CMaR's Notice of Substantial Completion.

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

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

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

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

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

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

3.14 MAINTENANCE

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

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

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

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

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

END OF SECTION 017000

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

C. CMaR shall develop and follow a Waste Management Plan designed to implement these requirements.

D. The following sources may be useful in developing the Waste Management Plan:

E. Methods of trash/waste disposal that are not acceptable are:
1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

F. Regulatory Requirements: CMaR is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT

A. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

B. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

C. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Regular job-site meetings.

D. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.

E. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

F. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

G. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017419

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

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

C. Warranties and Bonds:
1. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
2. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
2. Specifications.
3. Addenda.

4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

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

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

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

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

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

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

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

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

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

C. Additional information as specified in individual product specification sections.

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

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

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

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

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

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

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with red durable plastic covers; 32 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

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

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

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

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

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

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

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

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

END OF SECTION 017800

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

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

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

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

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

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

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

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

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

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

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

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

C. Provide training in minimum two hour segments.

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

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

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

G. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by CMaR.
11. Review spare parts suppliers and sources and procurement procedures.

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

END OF SECTION 017900

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SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of built site elements.

C. Selective demolition of building elements for alteration purposes.

D. Abandonment and removal of existing utilities relocated for new construction.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on CMaR's use of site and premises.

B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

D. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

E. Section 311000 - Site Clearing: Vegetation and existing debris removal.

F. Section 312200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

G. Section 312323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 312200 - Grading.

PART 3 EXECUTION

3.01 SCOPE

A. Remove the entire existing building as indicated on the Drawings..

B. Remove portions of existing buildings in sequencing as determined by the CMaR:

C. Remove paving and curbs as required to accomplish new work.

D. Remove all other paving and curbs within site boundaries.

E. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

F. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

G. Remove concrete slabs on grade within site boundaries.

H. Remove other items indicated, for salvage, relocation, and recycling.

I. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 312200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Use of explosives is not permitted.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without coordination of owner usages for bus and loading and unloading of students.
   7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

I. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Unused underground piping may be abandoned in place, provided it is completely drained and capped; remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 011000 for other limitations on outages and required notifications.
   4. Verify that abandoned services serve only abandoned facilities before removal.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

SECTION 031100 – CONCRETE FORMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to constructing concrete formwork as described herein and/or as shown on the Drawings.
   2. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to excavation and installation of spread and continuous footings as described herein and/or as shown on the Drawings.
   3. Formwork for site work concrete is specified in other sections.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this Section.

C. Related Sections:
   1. Section 033050 – Vapor Barrier.
   2. Section 032000 – Concrete Reinforcement.
   3. Section 033000 – Cast-in-Place Concrete.
   4. Geotechnical Investigation Report: Furnished by Owner.

1.02 REFERENCES

A. The Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following Codes or Specifications.
   1. ACI 301, Specifications for Structural Concrete of Buildings.
   2. ACI 318, Building Code Requirements for Structural Concrete.
   3. ACI 347R, Guide to Formwork for Concrete.

1.03 SYSTEM DESCRIPTION

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension. Design criteria shall conform to ACI 347R.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with other sections.

B. Shop Drawings: Submit a diagram of proposed construction joints not indicated on Drawings prior to or concurrent with reinforcing steel shop drawings.
   1. Shop drawings will be reviewed for proposed construction joint locations with respect to aesthetic criteria and general design conformance only.

C. Product Data: Submit complete manufacturer’s product data sheets for each specified product.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347R, ACI 301, and ACI 318.

B. Except when close coordination and fitting of various trades' work precludes allowance of tolerance, maximum total permissible deviations from established line, grades and dimensions shall conform to ACI 347R. Set and maintain forms in such manner as to ensure completed work within specified tolerance limits.
   1. Variation in location of embedded structural items unless provided with sleeves or other means of adjustment shall be a maximum of 1/4".

C. Footing installation Tolerances:
   1. Maximum lateral variation off of centerlines: 2".
   2. Plan Dimensions: Plus 3", minus 1/2".
   3. Thickness: Not smaller than scheduled si□es.
   4. Top of Footing Elevation: Plus 0", minus 3".

1.06 DELIVERY, STORAGE AND HANDLING

A. Form material shall be delivered to the job site as far in advance of its use as is practical, and shall be carefully stacked clear of the ground in such a manner as to facilitate air drying.

B. Store form materials and accessories on dunnage and under cover with protective sheeting.

C. Store void forms and installation instructions in manufacturer's packaging.

1.07 COORDINATION

A. Notify responsible trades of schedules of concrete pours to as to allow adequate time for installation and coordination of their work.

B. Schedule footing excavations such that reinforcing and concrete can be placed immediately after excavations are completed and inspected.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Forms: Wood, metal and other approved material that will not adversely affect surface of concrete and will provide or facilitate obtaining specified surface finish:
   1. Wood forms for unexposed concrete surfaces shall be built of No. 2 Southern Pine Lumber or other material of equal qualifications, of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces and so constructed as to be readily removable.
   2. Wood forms for exposed concrete surfaces shall be constructed of moisture-resistant, concrete form sheathing, not less than five (5) ply, and at least nine-sixteenths inch (9/16") thick, with one smooth face.
   3. Metal forms shall be clean, unpainted and in good condition. Forms shall at all times be straight to provide members of the widths and depths required. Damaged or indented forms will not be acceptable.
   4. Rustications and bevels in exposed concrete shown on the Drawings shall be neatly formed. All rustication strips shall be milled so that the edges are smooth and free from sawmarks or other irregularities.

2.02 FORMWORK ACCESSORIES

A. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

B. Corner Chamfer: 3/4 inch polyvinyl chloride PVC form strip.

C. Form Ties:
   1. Exposed concrete surfaces; shall be manufactured to allow a positive breakback of no less than one inch (1") inside the concrete surface. Ties shall be equipped with a plastic cone of not less than five-eighths inch (5/8") diameters and one inch (1") long which will completely cover the hole and prevent the leakage of any mortar.
   2. Unexposed surfaces; shall be bolt rods or patented devices having a minimum tensile strength of three thousand (3,000) pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than seven-eighths inch (7/8") in diameter, or depressions back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within one-inch (1") of the finished surface of the concrete.

D. Form Sealer: High performance, transparent, penetrating polyurethane sealer for wood forms.

E. Compressible Filler: Premolded plastic strips, non-asphaltic, ASTM D1752, Type 1.

F. Construction Joint Form: Manufactured key-joint form that produces smooth, flush surface joint.

G. Vapor Barrier: Plastic extrusion in accordance with Section 03 30 50 Vapor Barrier.

H. Waterstops: Synko-Flex Preformed Plastic Waterstop of Synko-Flex Products Co. or approved equivalent, meeting requirements of Fs SS-S-00210.

I. Void Form System: If required by Drawings, Void Forms to create a temporary support for placement of structural concrete over expansive soils shall be in accordance with Section 03 11 06 Void Forms.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Division 1, General Requirements – Execution, for additional requirements on Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
   1. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 ERECTION

A. All concrete members shall be adequately shored to safely support all loads and lateral pressures outlined in “Recommended Practice for Concrete Formwork” (ACI 347R), without distortion, excessive deflection and other damage.

B. All necessary forms, centering, shores and molds shall be built to conform to the shapes, lines and dimensions of the various members of concrete construction, as shown or scheduled on the Drawings. They shall be sufficiently tight and so substantially assembled as to prevent bulging or the leakage of mortar. All forms shall be assembled to facilitate their removal without damage to the concrete.

C. Provide temporary openings at the bottom of cast-in-place walls, columns and elsewhere as required to facilitate cleaning, drainage and inspection.

D. Construct forms with such care as to produce concrete surfaces which will not have unsightly or objectionable form marks in exposed (concrete) surfaces. Lumber once used as forms shall have all contact surfaces thoroughly cleaned before reuse.

E. Soffits: If indicated on Drawings, form the soffits of grade beams, walls and slabs bearing on piers using a void form system.

F. Slab Voids: If indicated on Drawings, install forms continuous and tightly butted together. Cut forms tight around all projections. Prior to placing reinforcements, entire carton form area shall be covered with topping sheets secured with ¾” staples.

3.03 FOOTING EXCAVATION

A. Spread and continuous footings shall extend to and penetrate bearing materials shown of the Drawings.

B. The exposed subgrade soils shall be examined in the field by a geotechnical engineer or the testing laboratory to verify the strength and bearing capacity of the soils.

C. Excavations and footings shall be the size and shape as shown on the Drawings. The bottom of each excavation shall be level, undisturbed, free of water, caving material or any other foreign substance.

3.04 FORM TIES

A. Form ties shall be employed in such places and at such intervals as to securely hold the forms in position during the placing of concrete, and to withstand the weight and pressure of the wet concrete. Ties of a type intended to be entirely removed shall be coated with release agent to safeguard against damaging the concrete during such removal. The use of wire ties will not be permitted.

3.05 WOOD STRIPS, BLOCKINGS AND MOULDINGS

A. Place in the forms wood strips, blocking, moulding, nailers, etc., as required to produce the finished profiles and surfaces shown on the Drawings and to provide nailing for wood members or other features required to be attached to concrete surfaces in such manner. Coat wood strips, blocking and moulding with release agent.

B. Chamfers: All exposed external corners of concrete member shall have 3/4" chamfer strips placed in the forms to relieve the angles.

3.06 FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.07 CONSTRUCTION JOINT

A. Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation, and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, the joints shall be located at or near the midpoints of spans.

B. Additional construction joints shall not be made under any circumstances without prior approval by the Architect. All construction joints must be either plumb or level. Provide appropriate keys and dowels in all construction joints, whether hori□ontal or vertical.

3.08 FORM CLEANING

A. Immediately before placing concrete, clean forms free of chips, wire clippings and other debris.

B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.09 INSERTS AND ACCESSORIES

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.10 WALLS

A. Construct concrete walls to the heights, thicknesses and profiles shown on the Drawings. Provide temporary openings at the bottom of all wall forms to facilitate cleaning and inspection. Close such openings securely, immediately in advance of pouring concrete in the wall forms. Provide appropriate keys and haunches in walls to receive free edge of concrete floors.

3.11 WATERSTOPS

A. Provide continuous waterstops in all joints below grade. Position waterstops accurately and support against displacement. Splice sections watertight in accordance with manufacturer’s recommendations.

3.12 VAPOR BARRIER

A. Install vapor barrier under all concrete floor slabs on grade and elsewhere as indicated on drawings. Smooth subgrade to prevent protrusions that may cause damage or rupture of film.

3.13 MISCELLANEOUS

A. Construct forms for any and all items of concrete work required for or in connection with the satisfactory completion of the project, whether each such item is specifically shown or referred to or not.

B. Do not sleeve any columns, beams, slabs or joists unless such sleeves are indicated on the Structural Drawings, or are previously approved on Shop Drawings by the Structural Engineer.

3.14 REMOVAL OF FORMS

A. Forms shall not be removed until the concrete has adequately hardened and set. Clamps or tie rods may be loosened twenty-four (24) hours after the concrete is placed; ties, except for a sufficient number to hold the forms in place, may be removed at that time. Throughwall ties that are to be wholly withdrawn shall be pulled toward the inside face of the respective wall or beam. Cutting ties back from the face of the concrete will not be permitted, and care shall be exercised to avoid spalling concrete surfaces. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

B. Formwork for concrete members that support the weight of concrete shall remain in place until the concrete has reached 75% of its specified 28-day strength, unless otherwise specified or permitted.

C. Under normal conditions, the minimum period of time to be allowed to elapse before forms may be removed shall be as indicated in ACI 347R, but its observance shall not operate to relieve the Contractor of the responsibility for the safety of the structure. Deviations shall be submitted to and reviewed by the Architect prior to removal of forms.

D. When the temperature falls below forty degrees Fahrenheit (40 degrees F.), the forms shall remain in place an additional period equal to the time the structure has been exposed to such lower temperature. Adequate measures shall be taken to protect the concrete from cold weather conditions.

E. Adequately reshore members subject to additional loads during construction to support both member and construction loads in a manner that will protect member from damage.

F. When reshoring is required, the operations shall be planned in advance and shall be the responsibility of the Contractor.

G. Contractor shall pay for and have Testing Laboratory make additional test cylinders to confirm strength requirements for early form recovery. Reshore before removing original shoring. Reshoring shall remain in place until members have attained required compressive strength, or as long as required to support additional construction loads.

3.15 FORM REUSAGE

A. Thoroughly clean surfaces of forms and remove nails before reuse. Do not reuse damaged or worn forms. Inspect forms and re-tighten rustications. Remove traces of joint treatment and where required for taping joints, remove traces of release agent with appropriate solvents.

B. Recoat contact surfaces of forms and liners with a light spray coat of release agent. Do not apply until after joint treatment is complete.

3.16 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements for a Contractor Quality Control Representative to perform contractor quality control inspections.
   1. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
   2. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
   3. Test and Inspection Reports shall be available to Architect upon request.

B. Footing Excavations:
   1. Soils Testing Laboratory shall inspect each footing excavation to determine that proper bearing stratum is obtained and utili□ed for bearing and that excavations are properly clean and dry before placing concrete.
   2. Furnish complete footing log showing location, elevation of top of bearing stratum, footing si□e and depth, condition of the material, excavation properly clean and dry before placing concrete, reinforcement in compliance with the Contract Documents and any and all observed irregularities, deficiencies or deviations from the Contract Documents.
   3. Footing excavation shall be scheduled such that the concrete can be placed immediately after inspection.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 031100

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SECTION 031106 – VOID FORMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pier top forms.
   2. Pier and grade beam void forms.
   3. Backfill retainers.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
   1. Section 031100 - Concrete Forming.
   2. Section 033000 - Cast-in-Place Concrete.

1.02 SYSTEM DESCRIPTION

A. Void Form System: Corrugated paper or plastic void form materials and accessories to properly create a temporary support for the placement of structural concrete over expansive soils.

1.03 SUBMITTALS

A. Division 1, General Requirements - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating form materials, configurations and limitations.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum five (5) years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum five (5) years documented experience.

B. Manufacturer Installation Instructions: Contractor shall maintain a current copy of void form manufacturer published instructions in Project Field Office and refer to installation instructions at all times during installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Accept Products on site in manufacturer’s packaging. Inspect for damage. Return damaged Products and replace with undamaged Products.

D. Deliver Material Safety Data Sheet (MSDS) for each material to Project Field Superintendent for Contractor Records.

E. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

F. Environmental Requirements: Place forms in clean dry grade beam excavation. Do not place forms if excavation is damp or wet. Do not place forms during rain or if rain is forecasted.

G. Water Spraying: Spraying water into grade beam excavation to clean top of previously placed pier not permitted. Clean top of pier concrete by means other than water. Keep void forms dry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: The design for Void Forms is based on the product named.
   1. SureVoid Products, Incorporated: www.surevoid.com.

B. Division 1, General Requirements - Product Options: Product options and substitutions. Substitutions: Permitted.

2.02 MATERIALS

A. Pier Top Forms: Suretop, Commercial. Cylindrical corrugated form that properly forms and contains upper portion of concrete piers.
   1. Composition: Waterproof corrugated plastic.
   2. Diameters: Slightly undersi□ed to pier diameter indicated on Drawings.
   3. Length: Maximum 24 inches.

B. Grade Beam Void Forms: WallVoid. Rectangular form with panel flange used in-between the panels of grade beam form system. Panels are placed on flange to hold piece in place preventing it from floating up into grade beam during concrete placement.
   1. Function: To create void space directly under grade beams.
   2. Composition: Corrugated paper material with a moisture resistant exterior, having an interior fabrication of a uniform, cellular configuration, composed with components with wet-strength paper and wax impregnated medium/liners and moisture resistant adhesive (Extra Slow).
   3. Depth: Indicated on Drawings.
   4. Position: Between form panels.
   5. Strength: For wall height indicated on Drawings based on manufacturer's recommendations.
   6. Accessories:
      a. Seam Pads: Cover for void form joints to prevent moisture and concrete from flowing in between and into wall void interior.
      b. End Caps: Covers exposed ends of void forms to prevent moisture and concrete from flowing into wall void interior.

C. Grade Beam Void Forms (Earth Formed Grade Beams): TrenchVoid. Rectangular form without flange used in bottom of trenched grade beam where earth is used to form beam. Width of form is same as trenched grade beam.
   1. Function: To create void space directly under grade beams.

2. Composition: Corrugated paper material with a moisture resistant exterior, having an interior fabrication of a uniform, cellular configuration, composed with components with wet-strength paper and wax impregnated medium/liners and moisture resistant adhesive (Extra Slow).
3. Depth: Indicated on Drawings.
4. Position: Between form panels.
5. Strength: For wall height indicated on Drawings based on manufacturer's recommendations.
6. Accessories:
   a. Seam Pads: Cover for void form joints to prevent moisture and concrete from flowing in between and into wall void interior.
   b. End Caps: Covers exposed ends of void forms to prevent moisture and concrete from flowing into wall void interior.

D. Pier Void Forms: Sure Round PierVoid.
1. Function: To create void space adjacent to upper portion of drilled piers under pier cap.
2. Composition: Same as WallVoid.
3. Interior Profile: Pre-manufactured, non-field cut, sealed unit with curved, radial, vertical edge adjacent to pier, diameter as required for pier diameter.
4. Strength: Same as WallVoid.

E. Slab Void Forms: Sure Void System.
1. Forms shall be capable of supporting not less than 1200 psf or actual load from deep wall or beam without deflection.
2. Fiberboard void forms for beam soffits below grade and slab voids shall be rectangular forms manufactured by Sure Void products.
3. Topping sheet shall be ¼" masonite or fiberboard 275# Natural Wax Impregnated Sheet.
4. Prior to placing reinforcements, entire carton form area shall be covered with topping sheets secured with ¾" staples.

F. Backfill Retainers: SureRetainer. Impact resistant, high-density, polyethylene (HDPE) plastic designed to prevent migration of backfill material into voided area and used to permit compaction equipment to operate directly adjacent to grade beam.
1. Retainer Extension Above Top of Void Form: Minimum 4 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Division 1, General Requirements – Execution for additional requirements on the Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 PREPARATION/INSTALLATION

A. Assemble knock-down products in accordance with manufacturer's published instructions to develop designed strengths.

B. Keep forms dry before placing concrete. Remove forms that are wet and replace with new forms.

C. Keep water away from trenches. Trenches shall be kept dry.

D. Place only as many forms as can be installed and utili□ed in a reasonable amount of time during controlled concrete placement.

E. Install forms and accessories in accordance with manufacturer's published instructions.

F. Protect void forms from moisture, and replace wet or damaged pieces before placing concrete.

G. Immediately protect base of wall after forms have been stripped with backfill retainers. Retainers will keep backfill material from migrating into voided area.

H. Install backfill retainers in accordance with manufacturer's published instructions.

I. Install backfill retainers at base of wall, overlap and seal pieces together and attach retainers to concrete grade beam.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements for a Contractor Quality Control Representative to perform contractor quality control inspections.
   1. Inspect installation of void forms, form type, material and configuration.
   2. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
   3. Test and Inspection Reports shall be available to Architect upon request.

B. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 031106

SECTION 032000 – CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to placing reinforcing steel for cast-in-place concrete as described herein and/or as shown on the Drawings.
   2. Supports and accessories for steel reinforcement.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:
   1. Section 031100 – Concrete Forming.
   Section 033000 - Cast-in-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 – Specifications for Structural Concrete for Buildings.
   2. ACI 318 – Building Code Requirements for Structural Concrete.
   3. ACI SP-66 – ACI Detailing Manual.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
   2. ASTM A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. ASTM A 706 – Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

C. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI MSP – Manual of Standard Practice.
   2. CRSI DET – Reinforcing Bar Detailing.

1.03 SUBMITTALS

A. Shop Drawings: Comply with requirements of ACI SP-66 and CRSI DET. Include installation drawings with complete bending diagrams, assembly diagrams for splicing and laps of bars, shapes, dimensions and details of bar reinforcing and accessories.
   1. Show diagrammatic elevations of walls at scale large enough to clearly show position and erection marks of marginal bars, around openings, dowels, splices, etc., for these bars.
   2. Show complete layout plan for each layer of reinforcing of slabs, beams and piers, showing number, arrangement, spacing, location, marking and orientations of reinforcement required for layer being described.
   3. Show details of drilled pier reinforcement placement including support and centering methods.

B. Mill Test Reports: Certified copies, evidencing compliance with the requirements of these Specifications, shall be delivered to the Architect and Engineer with all deliveries of reinforcing steel.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301, ACI SP-66, and ACI 318.

B. Reinforcing steel shall be new domestic steel. Use of foreign or steel of undetermined origin not permitted.

C. Steel supplier shall furnish mill certificate reports for all reinforcing.
1. Mill Test Reports shall be available for review by Architect and Engineer at time of delivery.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcing to project site in bundles marked with metal tags indicating bar size, length and mark.

B. Contractor shall receive reinforcing at site, inspect reinforcing for specified requirements and verify contents of mill certificate. Contractor shall require tests as specified in Quality Assurance article if mill certificate is not provided with shipment.

C. Unload reinforcing carefully to prevent damage. Store above ground in dry, well drained area and protect from mud, dirt, paint, corrosion, etc.

D. Deliver pier reinforcing steel in 40 and 60 foot lengths.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: ASTM A615, new, deformed billet steel bars, Grade 60. All reinforcement specifically noted as being welded shall be domestic steel conforming to ASTM A706.
1. New deformed billet-steel bars.

B. Welded Wire Fabric Reinforcing: ASTM A185, Grade 65, new, domestic manufacturer, steel wire spot welded at intersections and of sizes indicated. Supply in flat sheets, rolls not permitted.

C. Reinforcement Accessories: Include spacers, chairs, bolsters, ties and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place, conforming to the requirements of CRSI DET and ACI SP-66. Metal accessories shall be plastic protected where legs will be exposed in finished concrete surfaces. Plastic protection shall be the color of the concrete.
1. Tie Wire: FS QQ-W-461, black annealed steel, minimum 16 gauge.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
a. Supports for reinforcement in concrete resting on earth or vapor barrier shall be pre-cast concrete briquettes, having tie wires embedded therein, or Individual High Chairs with bottom plates.

D. Mechanical Splices: Lenton Taper Threaded Rebar Splices - as manufactured by ERICO Products or equal as submitted for approval.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI MSP and ACI SP-66.

B. Locate reinforcing splices not indicated on Drawings at point of minimum stress in accordance with CRSI MSP and ACI SP-66.

C. Fabricate pier cages in 40 and 60 foot lengths ready for cutting to exact lengths as pier shafts are drilled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Division 1, General Requirements – Execution for additional requirements on the Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 PREPARATION

A. Cleaning: Before placing in work thoroughly clean reinforcement of loose rust, mill, scale, dirt, oil, and other coating which might tend to reduce bonding. Re-inspect reinforcing left protruding for future bonding, or following delay in work, and re-clean if necessary.

B. In case of fabrication errors, do not straighten or re-bend reinforcement so as to weaken or injure the material.

3.03 PLACEMENT – REINFORCING BARS

A. Bar Placement: In accordance with ACI 301, ACI SP-66, ACI 318, and CRSI MSP.

B. Bending: Bend bars cold; do not heat reinforcing or bend by makeshift methods. Discard bent, kinked or otherwise damaged bars.

C. Splices: In accordance with ACI SP-66 and the Contract Documents.

D. Placing: Reinforcement shall be accurately placed and securely saddle tied in accordance with CRSI recommended practice with No. 16 gauge black annealed wire, and shall be rigidly held in place during the placing of the concrete by means of metal chairs or spacers.
   1. Reinforcement in concrete walls shall be held in position, and to proper clearances, by means of concrete or metal spacers made especially for the locations where spacers are required.
   2. Reinforcement in footings, beams and slabs shall be held to exact location during placing of concrete by spacers, chairs, or other necessary supports.

E. Supports: In accordance with ACI 301 and ACI SP-66 for number, type, spacing and placing.

F. Protection: Concrete cover over reinforcing steel shall conform to Structural Drawings or to ACI 318, Chapter 7.

G. Pier Cages: After each pier is drilled, the pier cage for that pier shall be cut to exact length and placed centered within pier shaft.
1. Splicing of pier cage reinforcing is Not Permitted in upper 5 feet of pier.
2. Bottom of pier cage shall be held in place above bottom of pier shaft as indicated on Structural Drawings.

H. Footing Reinforcing:
1. All steel reinforcing mats shall be completely fabricated in a rigid fashion in order to permit expeditious placement into the excavation with a minimum time delay.
2. Accurately place reinforcement in excavations, maintaining specified coverage. Secure to prevent displacement during concreting.

3.04 PLACEMENT – WIRE FABRIC

A. Install in longest practical lengths.

B. Do not make end laps midway between supporting beams, or directly over beams or continuous structures.

C. Offset end laps in adjacent widths to prevent continuous lap.

D. Welded wire fabric in footings, beams and slabs shall be held to exact location during placing of concrete by spacers, chairs or other necessary supports. Supports shall be spaced as required to hold welded wire fabric in place with a maximum spacing of 3 feet on center.

E. Lap splices shall be in accordance with ACI 318.

3.05 WELDING

A. No welding of reinforcing steel will be permitted unless specifically indicated on the Drawings.

B. Welding of reinforcing steel shall conform to AWS D1.4.

3.06 FIELD QUALITY CONTROL

A. Quality Control: Perform contractor quality control inspections.
1. Inspect reinforcement installation, steel type and grade, supports, spacers and ties before concrete placement.
2. Observe and report on placement of reinforcement, including size, quantity, vertical location, horizontal spacing, correctness of bends, splices, clearance between bars and forms, firmness of installation, and security of supports and ties, immediately prior to concreting.
3. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Testing and Inspection Services – Testing Laboratory Services: Perform the following inspections and tests.
1. If reinforcing steel is purchased direct from a United States mill, manufacturer's test sheets will be sufficient. Steel supplier shall furnish mill certificate reports.
2. If steel is from an undetermined origin or manufacturer's test sheets or mill certificate reports are unavailable, perform tension and bending tests on three separate samples of each size of bar for every five tons of each type of steel as specified in the appropriate

ASTM Specifications. Contractor shall furnish all material for testing and pay for all such tests.

END OF SECTION 032000

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SECTION 030000 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to placing of concrete as described herein and/or as shown on the Drawings.
   2. Includes all cast-in-place concrete building members, and MEP equipment pads. Includes mixing, placing, and finishing.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
   1. Section 033050 – Vapor Barrier.
   2. Section 031100 – Concrete Forming.
   3. Section 032000 – Concrete Reinforcement.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 211.1, Standard Practice for Selecting Proportions of Normal, Heavyweight and Mass Concrete.
   2. ACI 301, Specifications for Structural Concrete for Buildings.
   3. ACI 302.2R, Guide for Concrete Floor and Slab Construction.
   4. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   5. ACI 305R, Hot Weather Concreting.
   6. ACI 306R, Cold Weather Concreting.
   7. ACI 308, Standard Practice for Concrete Curing.
   8. ACI 309, Standard Practice for Consolidation of Concrete.
   9. ACI 311, ACI Manual of Concrete Inspection.
   10. ACI 318, Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM):
   1. ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33, Standard Specification for Concrete Aggregate.
   3. ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. ASTM C94, Standard Specification for Ready-Mix Concrete.
   5. ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   6. ASTM C143, Standard Specification for Slump of Portland Cement Concrete.
   7. ASTM C150, Standard Specification for Portland Cement.
   8. ASTM C172, Sampling of Freshly Mixed Concrete.
   9. ASTM C260, Standard Specification for Air-Entraining Admixtures.
   10. ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
   11. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.

12. ASTM C618, Standard Specification for Fly Ash and Raw or Calcined Natural Po□□olan for Use in Concrete.
13. ASTM E1155, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.03 SUBMITTALS

A. Mix Designs: The Contractor shall submit proposed mix designs in accordance with ACI 318.
   1. Proportions of cement, including fly ash content, fine and coarse aggregates, and water.
   2. Combined aggregate gradation.
   3. Aggregate specific gravity and gradations.
   4. Water-cement ratio, design strength, slump and air content.
   5. Type of cement and aggregates.
   6. Type and dosage of admixtures.
   7. Special requirements for pumping.
   8. Range of ambient temperature and humidity for which design is valid.
   9. Any special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product.
   10. Mix designs shall be accompanied with 30 strength test records not more than 24 months old in accordance with ACI 318, Table 5.3.2.1. If less than 30 test records are submitted, strength increases in accordance with the following will be required.
      a. Less than 30 tests but equal to or more than 15 tests: Table 5.3.1.2 and Table 5.3.2.1.
      b. Less than 15 tests: Table 5.3.2.2.
      c. No test records, no trial mixes and mix strength less that 5,000 psi: Section 5.4. Section requires a minimum strength of 1,200 psi greater than the specified strength.

B. Product Data: Submit manufacturers' data on manufactured products.
   1. Air entrainment admixture.
   2. Water reducing admixture.
   3. Waterstop.
   4. Expansion and control joints.
   5. Sealants and waterproofing.
   6. Reinforcing bars and wire mesh.
   7. Vapor barrier.
   8. Actual break-out of concrete materials if requested, (sand/gravel/cement).
   9. Concrete accessories, complete.
   10. Epoxy and grout.
   11. Lumber.
   12. Steel forms.
   13. Anchors.
   14. Architect may require additional information and or product material during construction. Provide when requested.

C. Shop Drawings: Submit a Control Joint and Construction Joint plan indicating proposed locations of control joints and construction joints in concrete floor slabs. Control joint and construction joint plan shall be mechanically drawn to scale.

D. Test Reports:
   1. Compressive strength tests for each set of test cylinders.
   2. Slump test for each set of test cylinders.
   3. Air content test for each set of test cylinders.
   4. Unit weight test for each set of test cylinders.

5. Temperature test for each set of test cylinders.
6. Floor Flatness and Levelness tests.

E. Special Inspection Reports:
1. Special Inspection Reports: Submit inspection reports directly to Building Official and Architect from Independent Special Inspector with copy to Contractor in accordance with requirements of International Building Code, Section 1704 - Special Inspections, if required by the Building Official.

1.04 QUALITY ASSURANCE

A. Source Quality Control:
1. Concrete production facilities shall meet the requirement for certification by the National Ready Mixed Concrete Association.
2. Concrete batchers shall be completely interlocked semi-automatic or automatic batchers, as defined by the Concrete Plan Manufacturer's Bureau.
3. Concrete batchers shall have graphic, digital, or photographic recorders, which shall register both empty balance and total weight (or volume of water or admixture) of each batched material, time to the nearest minute, date, identification of batch, and numerical count of each batch. Copies of the record shall be furnished to the Testing Laboratory.

B. Qualifications:
1. Installer: Company specializing in concrete work specified with minimum five (5) years documented experience.
2. Concrete Samples and Slump Tests:
a. Testing Agency: Sample cylinders taken and slump test performed by Independent Testing Laboratory personnel.
b. Contractor: Sample cylinders and slump tests may be taken by Contractor if taken by person trained in concrete sampling and testing, and holding a current ACI Concrete Laboratory Technician - Grade 1 Certification. Submit certification to Architect as part of Qualification Documentation.

C. Perform work of this section in accordance with ACI 301 and ACI 318.

D. Acquire cement from same source and aggregate from same source for entire project.

E. Concrete Floor Slab Moisture Emission and Acidity:
1. Do not place or permit placement of underslab granular mat if building area subgrade pad is wet. Place granular mat only when building area subgrade pad area is dry.
2. Do not place or permit placement of underslab vapor barrier over granular mat if granular mat is wet. Place underslab vapor barrier only when granular mat is dry. Refer to Section 03 30 50 - Vapor Barrier.
3. Do not add water into transit-mixer at Project site before concrete placement unless instructed by Independent Testing Laboratory representative as specified in this Section.
4. Concrete Contractor is responsible for properly curing concrete floor slab to provide concrete floor slab with moisture emission and acidity test results conforming to each floor material manufacturer requirements for moisture emission and acidity as specified in each floor material specification section when tested in accordance with ASTM F 1869. Refer to each floor material specification section for specific requirements.

1.05 PRODUCT DELIVERY, STORAGE, HANDLING AND SEQUENCING

A. Mix and deliver concrete to project ready-mixed in accordance with ASTM C94.

B. Schedule delivery so that continuity of any pour will not be interrupted for over 15 minutes.

C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

D. Coordinate Work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

1.06 PROJECT CONDITIONS

A. Hot Weather Concreting:
   1. Follow ACI 301 and ACI 305.
   2. Provide retarding type admixture conforming to ASTM C494, Type A or D in accordance with manufacturer's recommendations.
   3. Maximum concrete temperature shall not exceed 95 degrees F at time of placement.
      a. With prior approval, Concrete with temperatures above 90 degrees F shall be placed only if a high range water reducer (super plasticizer) is added to the mix as directed the Testing Laboratory to maintain the specified slump during placement.

B. Cold Weather Concreting: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures.
   1. Follow ACI 301 and ACI 306R.
   2. When ambient temperature at site is below 40 degrees F or is expected to fall to that temperature within ensuing 24 hours, measures shall be taken so that the temperature of concrete will be between 55 degrees F and 85 degrees F at time of placement.
   3. Once the concrete has been placed, it must be maintained at a temperature above 50 degrees F for minimum of 72 hours after placing.
   4. Temperature Changes: Maintain changes in concrete temperature as uniformly as possible, but in no case exceed change of 5 degrees F per hour or 25 degrees F in any 24 hour period.
   5. Combustion heaters shall not be used during the first 48 hours without precautions to prevent exposure of concrete and workmen to exhaust gases containing carbon dioxide and/or carbon monoxide.

C. Select admixture type (normal, retarder, or high early) best suited for concrete at the time of placing. The use of calcium chloride is specifically prohibited.

PART 2 PRODUCTS

2.01 FORMWORK

A. Standard Formwork: Specified in Section 03 11 00 - Concrete Forming.

2.02 REINFORCEMENT

A. Specified in Section 03 20 00 - Concrete Reinforcement.

2.03 CONCRETE MATERIALS

A. Cement/Fly Ash:
   1. Portland Cement, Type I, conforming to the requirements of ASTM C150.
   2. Fly Ash, Class C or F, conforming to the requirements of ASTM C618. The use of Fly Ash shall be subject to review by the Architect. Where Fly Ash is used in the mix design, Fly Ash shall comprise no more than 30% by weight of the total cementitious material in the mix. Fly Ash shall not be used in architecturally exposed concrete.

B. Aggregate:
   1. Fine: ASTM C33; clean, hard, durable, uncoated, natural sand, washed, free of silt, loam or clay.
   2. Coarse: ASTM C33; hard, durable, uncoated gravel, washed and screened without adherent coatings.
   3. Coarse aggregate for structural lightweight concrete shall conform to the applicable requirements of ASTM C330 suitably processed, washed and screened, and shall consist of durable particles without coatings. Gradation in accordance with Size Designation 3/4 inch to No. 4, Table 1, ASTM C330.
   4. Grading shall be in accordance with “Standard Method for Sieve Analysis of Sieve and Coarse Aggregates” (ASTM C136).

C. Water: ASTM C94, Paragraph 4.1.3; potable, clean and free from oil, acid and injurious amount of vegetable matter, alkalies, and other impurities.

2.04 ADMIXTURES

A. Cement-dispersing, water-reducing types. Admixtures shall conform to ASTM C494, Type A or D, and shall be used strictly in accordance with manufacturer’s recommendations and as determined by the Testing Laboratory. Admixture shall not discolor concrete or in any way affect the appearance of the concrete.
   1. High-range water reducing admixture conforming to ASTM C494, Type F, may be used.

B. An air-entraining admixture conforming to ASTM C260 shall be used as required.

C. Use of calcium chloride is specifically prohibited.

2.05 CONCRETE ACCESSORIES

A. Non-Shrink Grout: Premixed, non-shrink, non-metallic, cement grout requiring only addition of water. Minimum compressive strength of 5,000 psi at 7-days and 7,500 psi at 28 days when placed at a plastic consistency of 115% flow factor.

B. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.

C. Vapor Barrier: Specified in Section 03 30 50 - Vapor Barrier.

D. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

E. Joint Filler: Non-extruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, thickness as indicated on Drawings and width/depth as indicated.

F. Construction Joint Devices: Steel slab construction joints not permitted.

G. Miscellaneous Structural Metals Associated with Structural Concrete:
   1. All structural steel pieces including miscellaneous structural metals placed in concrete exposed to weather, in permanent contact with soil, or accessible to salt intrusion shall be hot dipped galvanized in accordance with ASTM A123.
   2. All structural steel pieces embedded in concrete shall conform to ASTM A36, unless noted otherwise on the Drawings.
   3. Welding of inserts, anchors and other steel pieces used in conjunction with structural concrete shall conform to AWS D1.1.
   4. Welding of reinforcing steel used in conjunction with structural concrete shall conform to AWS D1.4.

5. Headed stud anchors shall conform to ASTM A108, minimum tensile strength 60,000 PSI.
6. Concrete expansion anchors shall be wedge-type anchors, meeting the requirements of Federal Specifications FF-S-325, Group II, Type 4, Class 1, plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3. Size and location shall be as indicated on the Drawings.

2.06 CONCRETE MIX DESIGN

A. Strength: Concrete is classified and specified by ultimate compressive strength (f'c) at the age of 28 days.

B. Design concrete to ultimate compressive strengths (f'c) indicated on the Drawings.

C. Proportioning Concrete: Proportions of cement, aggregate, and water to attain required plasticity and compressive strength shall be in accordance with ACI 318. Do not make changes in proportions without submitting proposed changes to Testing Laboratory for evaluation.
1. Mix designs furnished by the concrete supplier, and accompanied by test data showing an acceptable strength history meeting the requirements of Method 2 as specified in section 3.8 of ACI 301.
   a. Temperature of concrete in test data shall be in within 5 degrees F of maximum temperature specified for this project.
   b. Strengths indicated in test data shall be in accordance with ACI 318, paragraphs 5.3 and 5.4.
   c. The specified strength of concrete used in supporting test data shall vary no more than 500 PSI plus or minus from that specified for this project.
2. The Testing Laboratory shall keep a strength history record of all concrete for the duration of the project as specified in this section.

2.07 SEALER

A. Use sealer on all areas specified in finish schedule for "Exposed Sealed Concrete".

B. Seal Concrete as soon as recommended by the manufacturer. Two coats at 600 ft. per two gallon.

C. Available Products: Subject to compliance with requirements equal to but not limited to the following:
1. Tiah by WR Meadows.

D. Restrict foot traffic for 12 hours after sealer is applies.

E. Apply third coat to areas exposed when necessary at completion of the project.

PART 3 EXECUTION

3.01 GENERAL

A. Classes of Concrete and Usage: Concrete of the several classes required shall have the characteristics shown on the Drawings.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify lines, levels, and dimensions before proceeding with work of this section.

2. Verify that screeding equipment is calibrated to provide concrete slab to specified flatness and levelness requirements.

C. Inserts: Give the various trades and subcontractors ample notification and opportunity to furnish any and all anchors, nailers, pipes, conduits, boxes, inserts, thimbles, sleeves, frame vents, wires, supports, or other items required to be built into the concrete by the provisions of the Drawings or of the Specification governing the work of such trades and subcontractors, or as it may be necessary for the proper execution of their work. Obtain suitable templates or instructions for the installation of such items which are required to be placed in the forms.

D. Mixing:
1. Transit-mixed concrete conforming to the requirements of ASTM C94 and ACI 304 shall be used in lieu of concrete mixed at the job site. Concrete shall not be transported or used in any case after a period in excess of ninety (90) minutes has elapsed after the introduction of water into the mixer.
2. Indiscriminate addition of water to increase slump of concrete is prohibited. Add water only at the direction the Testing Laboratory. No water shall be added which increases the water cement ratio of the concrete in excess of the water cement ratio indicated on the approved mix design. At the direction of the Testing Laboratory the addition of a high range water reducing admixture may be used to retemper concrete.
3. The agency supplying transit-mixed concrete shall have a plant of sufficient capacity and adequate transportation facilities, to assure continuous delivery at the rate required. The frequency of deliveries to the site of the work must be such as to provide for placing the concrete continuously throughout any one (1) pour.

E. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner. Costs for correcting unsuitable conditions will be at Contractor’s expense.

3.02 PLACING CONCRETE

A. Place concrete in uniform layers, approximately hori□ontal, and not more than eighteen inches deep, exercising care to avoid vertical joints or inclined planes. The piling up of concrete in the forms in such a manner as to cause the separation or loss of any of its ingredients will not be permitted. Concrete which has partially set or hardened shall not under any circumstances, be deposited in the Work.

B. Place concrete in the forms as nearly in its final position as is practical to avoid rehandling. Deposit concrete in hori□ontal layers maximum 24 inches and in a manner to avoid inclined construction joints. Exercise special care to prevent splashing the forms or reinforcement with concrete. Remove any hardened or partially hardened concrete which has accumulated on the forms or reinforcement before the work proceeds. Do no place concrete on previously deposited concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the respective member of section, except as hereinafter specified.

C. Placing Concrete Slabs: Place and consolidate concrete slabs in continuous operation, within limits of construction joints, until completion of panel or section placement.
1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or derbies to smooth surface free of humps or hollows. Do not disturb slab surfaces before beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

D. Do not permit concrete to drop freely any distance greater than five feet (5’). Where longer drops are necessary, use a chute, tremie, or other acceptable conveyance to assist the

concrete into place without separation. Do not pour directly into any excavations where water is standing.

E. Concrete shall be placed as soon as practical after footing excavations have been completed. If concrete is not to be placed within eight hours, a 3 inch thick lean concrete “working mat” shall be placed over the bearing surface of the exposed subgrade soils within four hours after the excavation has been completed. The “working mat” shall not extend above the bottom elevation of the spread or continuous footing.

F. Vibration: As soon as concrete is deposited, thoroughly agitate same by means of mechanical vibrators and suitable hand tools, so manipulated as to work the mixture well into all parts and corners of the forms and entirely around the reinforcement and inserts. Mechanical vibrators shall maintain frequencies in accordance with the recommendations of ACI 309, Table 5.1.4, and shall be operated by competent workmen. Over vibrating and use of vibrators to transport concrete within forms shall not be allowed. A spare vibrator shall be kept on job site during all concrete placing operations.

G. Conveying Concrete: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of the ingredients. Concrete to be conveyed by pumping shall be submitted to the Testing Laboratory for evaluation for each class of concrete shall be taken at the discharge end of the pumping equipment.

H. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to assure a practically continuous flow of concrete at the delivery end without separation of the materials. The use of gravity-flow or aluminum chutes or conveyors for transporting concrete horizontally will not be permitted.

I. Bonding: Before depositing any new concrete on or against previously deposited concrete which has partially or entirely set, the surface of the latter shall be thoroughly roughened and cleaned of all foreign matter, scum and laitance. Coat surface of previously deposited concrete with a bonding agent per manufacturer’s direction.

J. Construction Joints: Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, same shall be located at or near the midpoints of spans. Additional construction joints shall not be made under any circumstances without prior review by the Architect and Structural Engineer.

K. Protect all freshly placed concrete from washing by rain, flowing water etc. Do not allow the concrete to dry out from the time it is deposited in the forms until the expiration of the curing period.

L. Refer to structural drawings for column base plate and other structural grouting requirements.

M. Grout shall be mixed only in such quantities as are needed for immediate use. No retempering shall be permitted and materials which have been mixed for a period exceeding thirty (30) minutes shall in no case be used upon any portion of the work.

N. Imperfect or damaged work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be satisfactorily replaced at the Contractor’s expense and shall be in conformity with all of the requirements of the Contract Documents. Removal and replacement of concrete work shall be done in such a manner as not to impair the appearance or strength of the structure in any way.

O. Cleaning: Upon completion of the work, all forms, equipment, protective coverings and any rubbish resulting therefrom shall be removed from the premises. Finished concrete surfaces

shall be left in clean and perfect condition, satisfactory to the Owner. Sweep with an ordinary broom and remove all mortar, concrete droppings, loose dirt, mud, etc.

P. Separate slabs on grade from vertical surfaces with joint filler.

Q. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

R. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface.

S. Locate construction joints in coordination with floor slab pattern placement sequence. Provide keyways minimum 1-1/2 inches deep in walls and slabs and between walls and footings.
1. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless indicated otherwise.

T. Screed floors level, maintaining surface Flatness and Levelness in accordance with the Architectural requirements.

3.03 FIELD QUALITY CONTROL

A. Quality Control: Quality Control Representatives shall perform contractor quality control inspections.
1. Inspect concrete placement, concrete pumping, leveling and screeding operations.
2. Check floor slab for compliance with specified Floor Flatness and Floor Levelness.
3. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Testing and Inspection Services:
1. Perform the following tests.
a. Compressive Strength Tests: Perform minimum one (1) test for each 100 cubic yards or fraction thereof, of each mix design of concrete placed in any one (1) day. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.
1) Test Cylinders: Mold and cure four (4) 6"x12" or five (5) 4"X8" specimens from each set of samples in accordance with ASTM C 31.
2) Tests: Each set of four (4) 6"x12" or five (5) 4"X8" cylinders.
One (1) 6"X12" or 4"X8" cylinder at seven (7) days for information.
Two (2) 6"x12" or Three (3) 4"x8" cylinders at twenty-eight (28) days.
One (1) 6"X12" or 4"X8" cylinder held in reserve for minimum fifty-six (56) days tested as directed.
b. Slump Tests: Perform one (1) slump test for each set of samples in accordance with ASTM C 143 or as directed by Architect.
c. Air Content Tests: Perform one (1) test for each set of samples in accordance with ASTM C 231 or ASTM C 173.
d. Unit Weight Tests: Perform one (1) test for each set of samples in accordance with ASTM C 138.
e. Temperature Tests: Measure temperature of concrete sample for each set of samples.
f. Floor Flatness and Levelness Tests: Perform tests using measuring equipment in accordance with ASTM E 1155.
g. Test Results: Testing Laboratory shall report test results in writing to Architect and Contractor within twenty-four (24) hours of test.
2. Inspections: Perform the following inspections.

a. Batch Inspection and Monitoring Water: Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing from mixers before mix begins to set and within time limits set forth in ASTM C94.
   1) Monitor addition of water to concrete at job site and length of time concrete is allowed to remain in truck during placement.
   2) Certify each delivery ticket indicating class of concrete delivered, amount of water added and time at which cement and aggregate was discharged into truck, and time at which concrete was discharged from truck.

3. Test Procedures:
   a. Sample Technician: Test cylinders and slump tests performed only by person holding a current ACI Concrete Laboratory Technician - Grade 1 Certification.
   b. Sampling: Secure composite samples in accordance with ASTM C 172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
   c. Pumped Concrete Samples: Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.
   d. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
4. Test Reports:
   a. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
   b. Any deviations from the requirements of ASTM Specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C 39.
   c. Should strength of concrete fall below the minimum, then additional tests, including load tests, may be required. These tests, if required, shall be made at Contractor's expense and shall be in accordance with ASTM C42 and ACI 318. If tests do not meet applicable requirements, then structure, or any part of structure, shall be removed and replaced at Contractor's expense.
   d. Test reports shall include but not be limited to the following information:
      1) Date of concrete placement.
      2) Concrete mix identification number or proportions of ingredients.
      3) Truck ticket number.
      4) Time test was made.
      5) Time of batching.
      6) Location of each placement.
      7) Slump.
      8) Unit weight and air content of concrete sampled.
      9) Date and results of strength test.
   e. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.
   f. Any concrete testing requested by the Contractor for early formwork or shoring removal, etc., shall be at Contractor's expense.
   g. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by Architect. Information shall include, but not be limited to, the following:
      1) Strength test at seven (7) days.
      2) Strength tests at twenty-eight (28) days of two (2) cylinder averages.
      3) 28-day moving average strength tests of last three (3) test groups.

4) Standard deviation and coefficient of variation based on twenty-eight (28) day strength tests.
5) Average strength and number of twenty-eight (28) day tests for most recent month.

C. Testing and Inspection Services: Special Inspections.
1. Perform Special Inspections as required by the International Building Code Section 1704 - Special Inspections as indicated on Drawings, if required by the Building Official.

3.04 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Architect for each individual area.

D. Failed Strength Tests: If compressive strength tests indicate results below specified strength, Architect may require any or all of the following corrective measures be performed at Contractor's expense. Architect will determine extent of concrete removal if required.
1. Change concrete mix.
2. Core test in conformance with ASTM C 42.
3. Load test on portion or portions of structure where test cylinders indicate concrete is below specified strength. Load testing performed in conformance with ACI 318.
4. Remove and replace concrete below specified strength.

END OF SECTION 033000

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SECTION 033050 – VAPOR BARRIER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnish all labor, materials, services and equipment as required to place vapor barrier, seam tape, and mastic for installation under concrete slabs.

B. Related documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements apply to Work of this section.

C. Related sections:
   1. Section 031100 – Concrete Forming.
   2. Section 033000 – Cast-in-Place Concrete.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E 1745-11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E 154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
   3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.
   4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
   5. ASTM E 1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   6.

B. American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.03 SUBMITTALS

A. Quality control/assurance:
   1. Summary of test results as per paragraph 8.3 of ASTM E 1745.
   2. Manufacturer’s samples, literature.
   3. Manufacturer’s installation instructions for placement, seaming and penetration repair instructions.

1.04 QUALITY ASSURANCE

A. Conform to the requirements of ACI 302.2R.

B. Installer Qualifications: Company speciali□ing in performing under slab vapor barrier installations experienced in use of specified projects with minimum five (5) years documented experience in under slab vapor barrier installation.

C. Stego Manufacturer Regional Representative: Manufacturer representative shall be on-site the day of vapor barrier placement to instruct contractor in proper vapor barrier system installation, document installation and verify that proper procedures are followed.

D. Manufacturer Installation Instructions: Contractor shall maintain current copy of vapor barrier manufacturer published installation instructions in Project Field Office and refer to installation instructions at all times during installation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

B. Deliver vapor barrier in rolls in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Deliver Material Safety Data Sheet (MSDS) for each material to Project Field Superintendent for Contractor Records.

D. Accept Products on site in manufacturer's packaging. Inspect for damage. Return damaged Products and replace with undamaged Products.

E. Project Field Superintendent shall inspect Products immediately upon delivery to Project Site, determine Product conformance with specified requirements and reject Products not complying with specifications. Project Field Superintendent shall direct that non-complying Products be removed from Project Site immediately.

F. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide, 15 mil. Vapor barrier must have all of the following qualities:
1. Permeance of less than 0.01 Perms grains/(ft2 hr inHg) per ASTM F 1249 or ASTM E 96.
2. Maintain permeance of less than 0.01 Perms grains/(ft2 hr in.Hg) after mandatory conditioning tests per ASTM E 154 Sections 8,11,12, and 13.
3. Other performance criteria:
   a. Strength: ASTM E 1745 Class A.
4. Vapor barrier products:
   a. Stego Wrap 15-mil Vapor Barrier by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

2.02 2.2 ACCESSORIES

A. Seam tape:
1. Permeance less than 0.3 perms or lower per ASTM F 1249 or ASTM E 96.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Vapor-proofing mastic:
1. Permeance less than 0.3 perms or lower per ASTM F 1249 or ASTM E 96.

2. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Pipe Boots:
1. Construct pipe boots from vapor barrier material pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 EXECUTION

3.01 PREPARATION

A. Ensure that base material is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.

3.02 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643-11.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
2. Lap vapor barrier over footings and/or seal to foundation walls.
3. Overlap joints 6 inches and seal with manufacturer's tape.
4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements – Execution, for additional requirements on a Contractor Quality Control Representative to perform contractor quality control inspections.
1. Inspect installation of vapor barrier, pipe boots, penetration sealing and tear sealing.
2. Inspect under slab vapor barrier installation, verify that pipes, conduits, floor drains and other penetrations have been sealed and lap seams taped in conformance with ASTM E 1643-11 and manufacturers published instructions.
3. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Stego Manufacturer's Field Services:
1. Provide technical assistance and guidance for installation of under-slab vapor barrier system.
2. Inspect installation and certify that product has been furnished and installed in accordance with manufacturer's published instructions.
a. Prepare and submit inspection report for each inspection made.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 033050

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SECTION 033511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid densifiers and hardeners.

B. Clear coatings.

C. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

C. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

B. Clear Coating:

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
   1. Composition: Lithium silicate.
   2. Products:
      a. W. R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com/#sle. Tiah sealer

2.03 COATINGS

A. Concrete Stain or Dye: Translucent, penetrating compound for interior or exterior use; must be finished with a topical sealer.

B. High Gloss Clear Coating: Transparent, nonyellowing, acrylic polymer-based coating.
   1. Composition: Solvent-based.
   2. Products:
      a. Nox-Crete Inc; Sparkl-Seal: www.nox-crete.com/#sle.
      b. W. R. Meadows, Inc; Decra-Seal W/B: www.wrmeadows.com/#sle. Tiah sealer

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Final Polished Sheen: Satin finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not.
   2. Satin Finish: Reflecting images from side lighting.

B. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION 033511

SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block (CMU)

B. Common brick - Face Brick to match existing

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 072500 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.

B. Section 072700 - Air Barriers: Air barriers applied to exterior face of backing sheathing or unit masonry substrate.

C. Section 076200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

D. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2022.

C. ASTM A580/A580M - Standard Specification for Stainless Steel Wire 2018.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

H. ASTM C55 - Standard Specification for Concrete Building Brick 2017.

I. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale) 2017.

J. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2021.

K. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2021.

L. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.

M. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.

N. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2022a.

O. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.

P. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

Q. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

R. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.

S. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.

T. ASTM C476 - Standard Specification for Grout for Masonry 2020.

U. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

V. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.

W. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane 2015 (Reapproved 2021).

X. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

Y. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.

Z. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.

AA. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.

BB. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.07 MOCK-UPs

A. Construct a masonry wall as a mock-up panel sized 4' long by 4' high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.

B. Locate where directed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide nonstandard blocks configured for corners.
      a. Provide bullnose units for outside corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated. (reference structural for reinforcing & grout filled walls)
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block, as indicated. (reference structural for reinforcing & grout filled walls)

2.02 BRICK UNITS

A. Building (Common) Brick: ASTM C62, Grade SW; cored units.
   1. Nominal size: As indicated on drawings.
   2. Compressive strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.
   3. Color and Texture to match existing masonry on Classroom building & Gymnasium.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
   1. Colored Mortar: Premixed cement as required to match existing color of classroom building and gymnasium, provide samples to choose from and provide in masonry mock up.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Not more than 0.60 percent alkali.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
   2. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).

G. Water: Clean and potable.

H. Accelerating Admixture: Nonchloride type for use in cold weather.

I. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

J. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type N.
   2. Color: to match existing - verify and provide samples.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Hohmann & Barnard, Inc; X-Seal Anchor: www.h-b.com/#sle.

B. Reinforcing Steel: Type specified in Section 032000; size as indicated on drawings; galvanized finish.

C. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.

D. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

E. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss or ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
   1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

G. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.

2.05 FLASHINGS

A. Metal Flashing Materials:

B. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless Steel Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner.
   2. Stainless Steel/Polymer Fabric Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on inward facing side to a sheet of polymer fabric that has a clear adhesive with a removable release liner.

C. Membrane Non-Asphaltic Flashing Materials:
   1. Composite Polymer Flashings - Self-Adhering: Composite polyethylene; 40 mil thick with pressure-sensitive adhesive and release paper.
   2. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch thick.

D. Termination Bars: Stainless steel; compatible with membrane and adhesives.

E. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

F. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Weeps:
   1. Type: Polyester mesh.
   2. Color(s): As selected by Architect from manufacturer's full range.

D. Drainage Fabric: Polyester or polypropylene mesh bonded to a water and vapor-permeable fabric.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 LINTELS

2.08 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Exterior, non-loadbearing masonry: Type N.

2. Interior, loadbearing masonry: Type N.
3. Interior, non-loadbearing masonry: Type O.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Brick Units:
1. Bond: Running.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners, except for units laid in stack bond.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

L. Lay clay tile flue linings vertically, embedded in concrete block units.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.07 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, and CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center. - Reference structural for shelter area wall reinforcing.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

H. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 8 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
   2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   3. Terminate vertical leg of flashing into bed joint in masonry or reglet in concrete.
   4. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   5. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

D. Extend EPDM flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.10 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
   2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
   3. Openings over 78 inches: Reinforce openings as detailed.
   4. Do not splice reinforcing bars.
   5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
   6. Place and consolidate grout fill without displacing reinforcing.
   7. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8 inch bearing on each side of opening.

3.11 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.12 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints 3/4 inch wide and deep.

3.13 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042000

SECTION 042200 – CONCRETE MASONRY UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to construction of all concrete masonry units as described herein and/or as shown on the Drawings.
   2. Reference Structural notes on the Structural Drawings

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:
   1. Section 032000 – Concrete Reinforcement.
   2. Section 055000 – Metal Fabrications.
   3. Section 048100 – Unit Masonry.
   4. Section 071400 – Fluid Applied Waterproofing

1.02 1.2 REFERENCES

A. Concrete masonry unit manufacturer shall certify that masonry units furnished meet or exceed requirements of this Specification.

B. The work in this Section, unless noted on the Drawings, or herein specified shall be governed by the latest edition of the following codes or specifications.
   1. ACI 531 – Building Code Requirements for Concrete Masonry Structures.
   2. ASTM A 82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   3. ASTM C 145 – Standard Specifications for Solid Load Bearing Concrete Masonry Units.
   4. ASTM A 153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   6. ASTM C 90 – Standard Specification for Loadbearing Concrete Masonry Units.
   7. ASTM C 144 – Standard Specification for Aggregate for Masonry Mortar.
   8. ASTM C 150 – Standard Specification for Portland Cement.
   9. ASTM C 20 – Standard Specification for Hydrated Lime for Masonry Purposes.
   10. ASTM C 270 – Standard Specification for Mortar for Unit Masonry.
   11. ASTM C 404 – Standard Specification for Aggregates for Masonry Grout.
   12. ASTM C 476 – Standard Specification for Grout for Masonry.
   13. International Masonry Industry All-Weather Council (MIAWC):
      a. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction.
      b. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction.

1.03 SUBMITTALS

A. Product Data:
   1. Data for concrete masonry units, sizes, shapes and details. Include test data indicating block conformance to specified ASTM specification.
   2. Data for joint reinforcement.
   3. Data for block admixture integral water repellent.

B. Shop Drawings: Indicate reinforcing bar sizes, spacings, reinforcement quantities, bending and cutting schedules, reinforcement supporting and spacing devices, and accessories.

C. Samples for Verification: Submit set of unit masonry and mortar color samples to illustrate color, texture and extremes of color range for comparison with existing construction.

D. Assurance/Control Submittals:
   1. Test and Inspection Reports: Submit the following test and inspection reports in conformance with Division 1, General Requirements, for Testing and Inspection Services.
      a. Masonry, reinforcing and grouting inspections.
      b. Mortar and grout testing.
   2. Qualification Documentation: Upon request, submit documentation of experience and Regulatory Requirements indicating compliance with specified qualification requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in Work of this Section with minimum five (5) years documented experience.

1.05 STORAGE OF MATERIALS

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

B. Deliver materials to job site in undamaged condition.

C. Store concrete masonry units on raised platforms. Cover and protect units from inclement weather.

D. Store mortar and grout materials in manner to prevent intrusion of moisture and contaminants.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Cold Weather Requirements: Comply with recommendations of IMIAWC (CW).
      a. Lay no concrete masonry unit when air temperature is below 40 degrees F unless materials are protected from weather and laid up in shelter. In such instances, maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.
   2. Hot Weather Requirements: Comply with IMIAWC (HW).
      a. In temperatures exceeding 100 degrees F, do not lay out mortar beds ahead of placing units. Use a very light fog spray, not sufficient to penetrate masonry, on vertical surface of masonry to aid in mortar curing during that 24 hours after placing units.

1.07 COORDINATION

A. Coordinate Work with other trades in advance and make provisions for the installation of their work as masonry units are installed to avoid cutting and patching.

B. Coordinate masonry unit work with wall mounted lighting fixtures, plumbing items, openings and chases for heating ducts, plumbing pipes, electrical conduit and mechanical louvers or vents. Build into Work as construction progresses.

C. Provide for installation of bolts, toggles, flashing, beams, anchors, hangers, attachment strips, wall plugs and frames as required for support of structure and miscellaneous appliances.

PART 2 PRODUCTS

2.01 EXTERIOR WALL CONCRETE MASONRY UNITS

A. Concrete Block: ASTM C 90, Grade N, Type 1, light weight, load bearing, hollow block.
1. Integral block admixture water repellent added during block manufacture.
2. Integral color admixture pigment added during block manufacture to produce a uniformly colored surface.
3. Size and Shape: Locations indicated on Drawings.
   a. 16 inches x 8 inches and nominal depth of 8 inches.
   b. 16 inches x 8 inches and nominal depth of 12 inches.
4. Exposed Face Texture: Selected by Architect.
5. Color: Selected by Architect.
6. Provide standard and fire rated units.

2.02 INTERIOR PARTITION CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
1. Size: Standard units with nominal face dimensions indicated on Drawings.
   a. 16 x 8 inches and nominal depth of 8 inches.
   b. Bullnose Units: Provide bullnose units at all interior corners, unless indicated otherwise on Drawings.
2. Load-Bearing Units: ASTM C 90, Grade N, Type 1, light weight.
   a. Hollow block.
   b. Exposed Faces: Manufacturer's standard grey color and texture.
3. Fire Rated Partitions: Units listed in UL FRD or permitted by Building Code.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I; non-staining. Masonry cement not permitted.
1. Hydrated Lime: ASTM C 207, Type S.
2. Mortar Aggregate: ASTM C 144, free of clay or organic matter.
3. Grout Aggregate: ASTM C 404.

B. Water: Clean and potable.

C. Exterior Exposed Wall Mortar Color: Selected by Architect.
1. Integral mortar admixture water repellent added during mixing.

D. Interior Wall Mortar: Manufacturer’s standard grey color, U.N.O. by Architect.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A 615 Grade 60.
1. Deformed billet-steel bars.
2. Unfinished.

B. Single Wythe Joint Reinforcement - Truss type, ASTM A 82 steel wire, hot dipped galvanized after fabrication to ASTM A 153, Class B.
   1. 9 gauge side rods and cross rods and diagonal ties, welded at 16" intervals to continuous side rods forming truss design.
   2. Prefabricated corner and “tee” intersecting units.
   3. Width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
   4. Manufacturer:
      a. Dur-O-Wall: www.dur-o-wall.com.
      b. Holman & Barnard: www.h-b.com.
      c. Masonry Reinforcing Corporation of America: www.wirebond.com.
      d. Southern Construction Products: www.scponline.com.

2.05 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
   1. Type M: 2500 psi at 28 days or Type S: 1800 psi at 28 days; slump 9 inches plus or minus 1 inch.

B. Grout: ASTM C 476, Portland cement, sand, pea gravel and water, 2000 psi at 28 days, slump 9 inches plus or minus 1 inch. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Mixing:
   1. Mix mortar in accordance with ASTM C 270 in quantities needed for immediate use.
   2. Mix grout in accordance with ASTM C 476 in quantities needed for immediate use.
   3. Use mechanical batch mixer and comply with referenced standards.
   4. Do not use anti-freeze compounds to lower the freezing point of mortar or grout.
   5. Mix integral water repellent admixture per manufacturer’s published instructions.
   6. Control batching procedure to ensure proper proportions by measuring materials by volume. Measurement by shovel not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions to assure surfaces to support masonry are to proper grade, elevation, free from dirt or other deleterious matter and ready to receive Work.

B. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 PREPARATION

A. Concrete Masonry Units:
   1. Lay only dry units, free of paint, oil, efflorescence or foreign matter.
   2. Remove laitance, loose aggregate or anything that prevents bonding to surface.

B. Reinforcement: Before being placed, remove loose coatings from reinforcement.

C. Use masonry saws to cut masonry units.

D. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

E. Direct and coordinate placement of metal anchors supplied for installation under other sections.

F. Verify holes and openings have been sealed to prevent escape of insulation.

3.03 INSTALLATION

A. Installation Tolerances:
1. Maximum Variation from Plumb:
a. Vertical lines and surfaces of columns and walls:
1) 1/4" in 10'-0".
2) 3/8" in 20'-0" maximum.
3) 1/2" maximum.
b. External corners or control joints:
1) 1/4" in 20'-0".
2) 1/2" in 40'-0" maximum.
2. Maximum Variation from Level or Grades for Exposed Lintels, Sill, Parapets or Hori□ontal Grooves:
a. 1/4" on any bay or 20'-0".
b. 1/2" in 40'-0".
3. Maximum Variation from Plan Location of Linear Building Line or Related Portions of Columns, Walls and Partitions:
a. 1/2" in any bay or 20'-0".
b. 3/4" in 40'-0".
4. Maximum Variation in Cross-Sectional Dimensions of Columns and Thickness of Walls: 1/4”.

B. Pattern Bond: Running bond with vertical joints located at centerline of masonry units in alternate courses unless noted otherwise on architectural drawings.

C. General:
1. Set units plumb, true to lien and with level courses accurately spaced within allowable tolerances.
2. Do not install cracked, broken or chipped masonry units exceeding ASTM allowable or with Voids larger than ½” in any direction.
3. Adjust masonry unit to final position while mortar is soft and plastic.
4. Where adjustment must be made or if units are displaced after mortar has stiffened, remove units, clean joints and units of mortar and relay with fresh mortar.
5. Do not pound corners and jambs to fit stretcher units after they are set in position.
6. Adjust shelf angles to keep masonry level and at proper elevation.
7. Provide pressure relieving joints by placing continuous 1/8" foam pad under shelf angle.
8. Interlock intersections and external corners.
9. All exterior corners are to be rounded.

D. Mortar and Grouting:
1. Place mortar in accordance with ASTM C 270.
a. Lay with full mortar coverage on hori□ontal and vertical face shells.
b. Provide full mortar coverage on hori□ontal and vertical face shells and webs where adjacent to cells of cavities to be filled with grout.
2. Place grout in accordance with ASTM C 476.

3. Provide protection for metal building frames and girts during placement of mortar and grout. Do not permit mortar or grout in contact with metal building frames and girts.
4. High-Lift Grouting is not acceptable without prior written consent of the Engineer of Record.
5. Low-Lift Grouting is acceptable as follows:
   a. Limit height of pours to 60 inches.
   b. For grout pours 12 inches high or less, the grout may be consolidated by rodding with a puddling stick.
   c. For grout pours in excess of 12 inches, the grout shall be consolidated by means of a mechanical vibrator.
   d. At intermediate levels, the top of the grout pour shall stop a minimum of 1 □ inches below the top of the masonry units.
   e. At the top of the wall, the grout shall be placed flush with the masonry units.
   f. Pour grout only after vertical reinforcing is in place; place hori□ontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   g. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1 □ hours.
6. Remove excess mortar from grout spaces.

E. Hori□ontal and Vertical Face Joints:
1. Construct uniform joints, 3/8" nominal thickness.
2. Shove vertical joints tight.
3. Tool concave joints in exposed surfaces when thumb-print hard with round joints slightly larger than width of joint.
4. Flush cut all joints not exposed.
5. Fill hori□ontal joints between top of non-load bearing masonry partitions and underside of beams or slabs with flexible material.

F. Control Joints:
1. Keep joints free of mortar by inserting continuous wood or metal temporary strips.
2. Install where indicated and at following locations:
   a. Changes in thickness, height and direction.
   b. Within 8'-0" of corners or offsets.
   c. At control or expansion joints in structure.
   d. At each side of openings greater than 24" wide.
   e. At foundation walls, shelf angles, setbacks and materials expanding at different ratios.
   f. Space joints at 30'-0" o.c. maximum in uninterrupted walls.
   g. Provide continuous vertical control joints through bond beams except at lintels above openings.
   h. Offset control joints to ends of lintels.
3. Install joint sealer as specified by Architect.

G. Collar Joints:
1. Keep cavity in cavity walls clean.
2. Remove all protruding mortar fins in cavity to be grouted.

H. Joining of Work:
1. When joining fresh masonry to set or partially set masonry construction, remove loose units and mortar and clean exposed surface of set masonry prior to laying fresh masonry.
2. If necessary to stop off hori□ontal run of masonry, rack back one-half block length in each course.
3. Do not use toothing to join new masonry to set or partially set masonry.

I. Reinforcing and Ties:

1. Reinforcing Bars: Secure at locations indicated and to avoid displacement during grouting.
   a. Maintain position within 1/2 inch of dimensioned position.
   b. Minimum spacing between bars or to masonry surfaces shall be one bar diameter.
2. Hori□ontal joint reinforcing: Install hori□ontal joint reinforcement 16 inches on center.
   a. Place masonry joint reinforcement in first and second hori□ontal joints above and below openings. Extend minimum 16 inches each side of opening.
   b. Place continuous joint reinforcement in first and second joint below top of walls.
   c. Extend joint reinforcement entire length of bed joint.
   d. Lap reinforcement minimum 6" at ends.
   e. Bend or weld at offsets or special conditions.

J. Bond Beams:
1. Provide CMU bond beams at top of CMU walls and lintels above openings.
2. Reinforce bond beams with minimum of two bars and grout. Support and secure reinforcing bars from displacement during grout fill.
3. Discontinue bond beams at expansion and control joints.
4. At bearing locations, fill masonry cores with grout for minimum 16 inches either side of opening.

K. Flashing:
1. General:
   a. Clean surface to receive flashing and remove projections which might puncture or damage flashing material.
   b. Seal joints with manufacturer’s recommended adhesive.
   c. Seal top of flashing to ensure moisture cannot infiltrate behind flashing.
   d. Continue flashing around corners. Ensure membrane material is not interrupted in hori□ontal plane at corners.
2. Wall base, opening sills and heads:
   a. Place flashing on mortar bed and cover with mortar.
   b. Start 1/2" from outside face of wall and turn up in cavity 8" minimum.
   c. Lap joints 4" minimum.
   d. Place flashing under and behind sills.
   e. Place flashing over steel lintels.
   f. Extend flashing beyond opening jamb lines.

L. Weep Holes:
1. Provide weep holes in head joints in first course immediately above flashing by either leaving head joint free and clean of mortar or placing and leaving sash cord or plastic weeps in joint.
2. 24" o.c. maximum spacing.
3. Keep weep holes and area above flashing free of mortar waste.

M. Built-In Work:
1. As work progresses, install built-in metal door frames, window frames, fabricated metal frames, mechanical louvers, plates and anchor bolts and other items to be built into the work and furnished under other sections.
2. Install built-in items plumb, level and true to line.
3. Where electric conduit, outlet, switch and other boxes occur, grind and cut units before building-in services. Coordinate work with electrical installer.
4. Bed anchors of metal door frames in adjacent mortar joints.
   a. Fill frame voids solid with grout.
   b. Fill adjacent masonry cores with grout minimum 12 inches for framed openings.
5. Do not build into masonry construction organic materials that are subject to deterioration.

6. Where recessed fire extinguisher cabinets, recessed drinking fountains, electric conduit, outlet, switch and other boxes occur, grind and cut units before building-in services. Coordinate with item installer.

3.04 CLEANING

A. Clean work. Remove efflorescence in accordance with manufacturer's recommendations.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Leave area and surfaces clean and free of mortar spots, drippings and broken masonry.

3.05 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements for a Contractor Quality Control Representative to perform contractor quality control inspections.
1. Inspect concrete masonry unit erection, color, texture, coursing, joints, placement and type of reinforcing, reinforcing splicing, mortar and grout mixing, and grouting.
2. Cull any block voids larger than ½" diameter or dimension in any direction.
3. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Refer to Division 1, General Requirements, for Testing and Inspection Services: Perform the following inspections.
1. Perform the following inspections for conformance compliance with Contract Documents.
a. Start of Masonry Work:
1) Concrete unit masonry si□e, grade and type.
2) Proportions of site-prepared mortar.
3) Construction of mortar joints.
4) Location of reinforcement and connectors.
5) Specified si□e, grade and type of reinforcement.
6) Protection of masonry during cold weather or hot weather.
b. Before Grouting:
1) Verify that grout space is clean.
2) Placement of reinforcing and connectors.
3) Proportions of site-prepared grout.
4) Construction of mortar joints.
c. Grout placement and grouting procedures.
2. Perform the following tests:
a. Mortar: Test and evaluate mortar in accordance with ASTM C 780.
1) Take 3 samples of mortar each day.
b. Grout: Test and evaluate grout in accordance with ASTM C 1019.
1) Take 3 samples of grout each day.
c. Prism: Test in accordance with ACI 530.1.
1) Perform 1 prism test for each 5,000 square feet of wall.
3. Reports: Prepare and submit test reports indicating results of tests made as specified in Division 1, General Requirements, Quality Control.

C. Refer to Division 1, General Requirements - Testing and Inspection Services: Special Inspections.

1. Perform Special Inspections as required by the International Building Code Section 1704 - Special Inspections, as indicated on Drawings and as required by the Building Official.

D. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Without damaging completed work, provide protective boards at external corners which may be damaged by construction activities.

END OF SECTION 042200

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SECTION 051200 – STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to installation of structural steel as described herein and/or as shown on the Drawings.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
1. Section 052100 – Steel Joist Framing.
2. Section 053100 – Metal Deck.
3. Section 055500 – Metal Fabrications.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC):
1. AISC M016 – ASD Manual of Steel Construction.
2. AISC S303 – Code of Standard Practice for Steel Buildings and Bridges.

B. American Society for Testing and Materials (ASTM):
1. ASTM A 36 – Standard Specification for Carbon Structural Steel.
2. ASTM A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
4. ASTM A 108 – Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
5. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
6. ASTM A 501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
7. ASTM A 992/992M – Standard Specification for Steel for Structural Shapes for Use in Building Framing.
8. ASTM C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
9. ASTM E 164 – Standard Practice for Ultrasonic Contact Examination of Weldments.

C. American Welding Society (AWS):
1. WS A2.4 – Standard Symbols for Welding, Bra□ing, and Nondestructive Examination.
2. AWS D1.1 – Structural Welding Code - Steel.

D. Steel Structures Painting Council (SSPC):
1. SSPC 1 – Solvent Cleaning.
2. SSPC 3 – Power Tool Cleaning.
3. SSPC-Paint 15 – Steel Joist Shop Primer; Society for Protective Coatings.

1.03 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC M016.

B. Erector Qualifications:
1. Company specializing in performing structural steel erection work with minimum five (5) years documented experience.
2. A qualified installer who participates in the AISC Certification program and is designated an AISC Certified Erector, Category CSE at the time of bid.

C. Fabricator Qualifications:
1. Company specializing in performing structural steel fabrication work with minimum ten (10) years documented experience.
2. A qualified fabricator who participates in the AISC Certification program and is designated an AISC Certified Plant, Category STD at the time of bid.

1.04 SUBMITTALS

A. Division 1, General Requirements - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Structural steel (each type), including certified copies of all mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washer.
3. Structural steel primer paint.
4. Non-shrink grout.

C. C. Shop Drawings:
1. Submit shop drawings prepared under the supervision of a registered Professional Engineer licensed in the State in which the project is located in accordance with Specifications.
2. Show complete details and schedules for the fabrication and shop assembly of members. Detail to conform to AISC "Structural Steel Detailing". Clearly indicate profiles, sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings, size and type of fasteners and cambers. Show AWS weld types.
3. Shop drawings shall include erections sequences, procedures, diagrams, schedules and compete details. Provide setting drawings, templates and directions for installation of anchor bolts and other anchorages to be installed by others. Any fabrication of material before review of shop drawings shall be at the risk of the contractor.
4. The Contractor shall completely outline a proposed method and sequence of erection to the Architect for review before delivering any material to the job site. The outline shall be prepared to avoid delay or any damage to the work of other trades.

D. Welder's Certificate: Submit Welder's Certifications performed by a qualified testing laboratory in accordance with AWS standards within the previous twelve (12) months.

E. Test Reports: The Testing Laboratory shall submit copies of reports of shop and field inspections and test performed in accordance with Specifications.

F. Special Inspection Reports: Submit the following inspection reports directly to Building Official and Architect from Independent Special Inspector with copy to Contractor in accordance with requirements of International Building Code, Section 1704 - Special Inspections, if required by the Building Official.

1.05 STORAGE OF MATERIALS

A. Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Material stored at the job site shall be placed so that design loads on existing or newly constructed structures are not exceeded and members will not be distorted or otherwise damaged. All materials shall be protected against corrosion or deterioration of any kind.

B. The Architect/Engineer will reject any material that has become damaged because of improper storage.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials shall be new and shall conform to the respective specifications (latest revision) and other requirements specified below.
   1. Structural Steel Wide Flange and WT Shapes: ASTM A 992.
   2. Structural Steel Angles, Channels and Plates: ASTM A 36.
   3. Steel Pipe: ASTM A53, Type “E” or “S”, Grade B, or ASTM A501.
   4. Steel Tube: ASTM A500, Grade B, 46, ksi.
   5. Bolts: Erection bolts not specified as high strength shall meet requirements of ASTM A307, Grade A.
      a. High Strength bolts shall meet ASTM A325.
      b. Embedded Anchor Rods and Headed Bolts shall meet requirements of ASTM F1554 Grade 36.
      c. Nuts: ASTM A563 and ANSI B18.2.2.
      d. Washers: ASTM F436.
      e. Direct tension indicator bolts or load washers conforming to AISC Specifications for Structural Joints.
   6. Welding Electrodes: AWS D1.1 for Series E70 electrodes.
   7. Headed Stud Anchors: ASTM A108, minimum tensile strength 60,000 PSI.
   8. Galvani□ing: All items of structural steel noted to be galvani□ed shall conform to ASTM A123 (latest edition). All anchors, bolts washers, etc. in conjunction with galvani□ed surfaces shall also be galvani□ed to conform to these requirements.
   9. Grout: Premixed non-shrink, non-metallic aggregate type, complying with ASTM C 1107 and capable of developing a minimum compressive strength of 7,500 psi at 28 days when placed at a plastic consistency of 115 percent flow factor.
   10. Shop and Touch-up Primer: SSPC-Paint 15, Type I - Red Oxide.

2.02 FABRICATION

A. General:
   1. All work shall be shop assembled to greatest extent possible and delivered to the project site complete and ready for erection. Material shall be properly marked and match-marked where field assembly is required. The sequence of shipments shall be such as to expedite erection and minimi□e field handling of material.
   2. Steel Members shall be cambered if so indicated on the Drawings.
   3. Steel members without specified camber shall be fabricated so that after erection, any minor camber due to rolling or fabrication shall be upward.

B. Connections:
   1. Connections shall conform to the standard specifications of the AISC.
   2. Connections not detailed on the Drawings shall be selected from Part 4 of the Manual of Steel Construction of the AISC.

3. Shop and field connections shall be bolted or welded as detailed.
4. No combination of bolts and welds shall be used for stress transmission in the same faying face of any connection.

C. Shop Welding:
1. All welding shall be done in accordance with AWS D1.1.
2. Intermittent and continuous welding shall be done in a manner to minimize internal stress.
3. Welds not specified shall be continuous fillet welds, sufficient to transmit required forces, using minimum fillet as specified by AWS D1.1.

D. Openings for other work: Provide openings in structural members only as shown on the structural drawings, or as directed by the Architect.

E. Shop Painting:
1. Shop paint structural steel work, except those members or portions of members to be embedded in concrete or mortar, or contact surfaces which are to be welded or high-strength bolted. Paint embedded steel on exposed portions and initial 2" of embedded areas only. Do not paint steel surfaces which are to receive sprayed-on fire proofing.
2. Surface Preparation: Clean steelwork to be painted complying with SSPC SP 3. Remove oil, grease and similar contaminants, complying with SSPC SP-1.
3. Application: Immediately after surface preparation, apply one coat of structural steel primer paint according to manufacturer's instructions to provide a uniform dry film thickness of 2.5 mils. Provide full covering on joints, corners, edges and all exposed surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Division 1, General Requirements, for requirements on Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify that conditions are appropriate for erection of structural steel and that Work may properly proceed.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 PREPARATION

A. Templates shall be secured in place to preclude misplacement of anchor bolts, and the bolts shall be installed at locations and with projections established on final structural steel shop drawings. Check correct positioning before concrete is placed.

B. Furnish items required to be cast into concrete or embed in masonry with setting diagrams to appropriate Sections.

3.03 ERECTION

A. Tolerances: Unless otherwise noted, structural steel shall be erected in accordance with AISC S303.

B. Temporary Bracing: Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb and in true alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members without approval of Architect and Structural Engineer.

D. Field weld components indicated on shop drawings.

E. After erection, prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete.

F. Grouting of Base Plates and Bearing Plates: Plates shall be set and anchored to the proper line and elevation. Metal wedges, shims and/or setting nuts shall be used for leveling and plumbing of structural members, including columns. Concrete surfaces shall be rough, free of oil, grease and laitance, and shall be damp. Steel surfaces shall be clean and free of oil, grease and rust. Mixing and placing shall be in conformance with the material manufacturer's instructions. Grout shall be mixed by using a mortar mixer. Batches shall be of si□e to allow continuous placement of freshly mixed grout. Placing shall be quick and continuous. Exposed surfaces shall have smooth, dense finish.

G. Headed Stud Anchor Welding: All members or items to which studs are to be attached must be free of all foreign material, such as rust, oil, grease, paint, etc. When the mill scale is sufficiently thick to cause difficulty in obtaining proper welds it must be removed by grinding or sandblasting. Ceramic ferrules used in the stud welding process shall be completely removed.

3.04 FITTING OF STRUCTURAL MEMBERS

A. The Contractor alone shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure.

3.05 ADJUSTMENTS

A. Any adjustments necessary in the steel frame because of fabrication, construction or erection discrepancies in elevation and alignment shall be the responsibility of the Contractor. Any modification to the approved manufactured material shall be approved by the Architect and Structural Engineer.

3.06 CONSTRUCTION

A. Interface with Other Work:
   1. Meet with steel joist and pre-engineered metal building erector to coordinate connection requirements and scheduling for erection interface.

B. Site Tolerances:
   1. Maximum Variation From Plumb: 1/4 inch.
   2. Maximum Offset From True Alignment: 1/4 inch.

3.07 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements on Quality Control: Contractor Quality Control Representative shall perform contractor quality control inspections.

1. Inspect structural steel member installation, sizes, configurations and connections.
2. Visually inspect field-welded connections.
3. Visually inspect bolted connections.
4. Document preparatory, initial and follow-up inspection in Contractor's Test and spection Reports.
5. Test and Inspection Reports shall be available to Architect upon request.

B. Contractor shall provide the Testing Laboratory with names of welder to be employed on work, during fabrication and erection, together with certification that each of these welders has passed qualifications tests within the last year, unless noted otherwise, in accordance with AWS Standards.

C. Inspect all structural steel during and after erection for conformance with Contract Documents and shop drawings. Any cases of insufficient bracing or guying, or other unsafe conditions shall be immediately called to attention of Contractor and reported to Architect.
   1. No burning or other field corrections of steel members are permitted without express permission of Owner's representative. Immediately report violations.
   2. Shop Inspection:
      a. Review shop drawings and shop procedures with fabricator's supervisory personnel.
      b. Request and obtain necessary mill certification of steel and verify proper material throughout the duration of the job, as required.
      c. Review welding procedures and welder operator qualifications for conformance to the technical requirements of the Specifications.
      d. Check layout and dimensions of jigs and fixtures for multiple fabrication, joint preparation, fit-up and run-out plates.
      e. Verify welding electrodes to be used and other welding consumables as job progresses.
      f. Check preheating procedure for uniformly and thoroughness through the full thickness of material.
      g. Make visual inspection of welding in progress for size, length and quality.
      h. Check bolted connections as required by the technical requirements of the Specifications.
      i. Perform random dimensional checks of completed members.
      j. Provide inspection of surface preparation for coating and coating operations.
   3. Field inspection:
      a. Obtain planned erection procedure and review with erector's supervisory personnel.
      b. Check installation of anchor bolts and base plates.
      c. Verify field welding procedures and welder qualifications to assure conformance with the Specifications.
      d. Check steel as received in field for possible shipping damage, workmanship and piece marking.
      e. Check plumbness, alignment and chamber as erection progresses including proper bracing.
      f. Check joint preparation, fit-up, backing strips and runout plates.
      g. Check preheating to assure proper temperature, uniformity and thoroughness through the full material thickness.
      h. Review welding sequence.
      i. Visually inspect field welding for size, length and quality.
   4. Inspection of High-Strength Bolted Construction shall be in accordance with the latest edition of AISC Specification for Structural Joints, and as follows:
      a. All high-strength bolted connections shall be visually inspected.

b. At least two bolts of every third connection between floor beams and girders shall be checked with a calibrated torque wrench for proper torque.
c. At least two bolts of every third connection between girders and columns shall be checked as above.
d. All bolts in every connection in the primary exterior framing and braced framing shall be checked as above.
e. All bolted connections that fail shall be corrected and all bolts in the connection shall be retested.
f. Check calibration of impact wrenches at least twice daily.

5. Inspection of all welds shall be in accordance with the latest edition of the AWS Structural Welding Code.
   a. Visually inspect all welds in accordance with AWS D1.1.
   b. All penetration column to base plate welds shall be inspected by ultrasonic testing in accordance with ASTM E-164.
   c. All full penetration welds in moment connections shall be inspected by ultrasonic testing.
6. Inspection of headed stud connector welding shall be in accordance with the latest edition of the AWS Structural Welding Code and as follows:
   a. Visual inspection of all studs shall indicate complete fusion and weld flush or fillet for 100 percent circumference. There will be no indication of lack of infusion or undercut weld.
   b. A minimum of two (2) shear studs shall be welded at the start of each production period in order to determine proper generator, control unit and stud welder setting. These studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, such stud shall be struck with a hammer and bent 15 degrees off perpendicular to the nearest end of the beam. Studs failing under this test shall be replaced.

D. Refer to Division 1, General Requirements, for requirements on Testing and Inspection Services - Testing Laboratory Services: Special Inspections.
   1. Perform Special Inspections as required by the International Building Code Section 1704 - Special Inspections, as indicated on Drawings and as required by the Building Official.

E. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 051200

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SECTION 052100 – STEEL JOISTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Perform labor, materials, services and equipment as required to complete the steel joist and joist girder work indicated by the Contract Documents and furnish all supplementary items such as bridging, attached seats and anchors necessary for its proper installation.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:
   1. Section 033000 – Cast-in-Place Concrete.
   2. Section 042200 – Concrete Masonry Units.
   3. Section 051200 – Structural Steel.
   4. Section 053100 – Metal Deck.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 36 – Standard Specification for Carbon Structural Steel.
   2. ASTM A 108 – Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

B. American Welding society (AWS):
   1. AWS D1.1 – Structural Welding Code - Steel.

C. Steel Joist Institute (SJI):
   1. SJI (SPEC) – Standard Specifications Load Tables and Weight Tables for Steel Joists, Longspan Joists and Joist Girders.
   2. SJI Technical Digest No. 9 – Handling and Erection of Steel Joists and Joist Girders.

D. Steel Structures Painting Council (SSPC):
   1. SSPC SP 2 – Hand Tool Cleaning.
   2. SSPC-Paint 15 – Steel Joist Shop Primer.

1.03 SUBMITTALS

A. Refer to Division 1, General Requirements - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Indicate joist types using standard SJI designations, spacing, location, bridging, anchorages and special conditions.
   2. Indicate welded field connections using standard AWS welding symbols.
   3. Indicate paint primer type, accessories and installation details.
   4. Joist setting plan.

C. Assurance/Control Submittals:
   1. Inspection Reports: Submit the following inspection reports directly to Architect from Independent Testing Laboratory with copy to Contractor.
      a. Testing Laboratory Inspection of steel joists.
   2. Certificates: Submit certificate with shop drawings stating joists and joist girders are manufactured by a member of the Steel Joist Institute and conform to the requirements of the Steel Joist Institute Standard Specifications.
      a. Submit certified copies of mill test reports covering chemical and physical properties of steel used in work.
   3. Welders Certificates: Certify welders to AWS standards within previous twelve (12) months.
   4. Qualification Documentation: Upon request, submit documentation of experience indicating compliance with specified qualification requirements.

1.04 QUALITY ASSURANCE

A. Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications Load Tables and SJI Technical Digest No.9.

B. Qualifications:
   1. Fabricator: Member in good standing of the Steel Joist Institute.
   2. Erector: Company speciali□ing in performing the work of this section with minimum five (5) years documented experience.
   3. Welders: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed on Work have satisfactorily passed AWS qualification tests within previous twelve (12) months.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Refer to Division 1, General Requirements - Product Options: Transport, handle, store and protect Products.

B. Transport, handle, store and protect products to SJI requirements.

C. Accept Products on site in manufacturer’s packaging. Inspect for damage. Return damaged Products and replace with undamaged Products.

D. Project Field Superintendent shall inspect Products immediately upon delivery to Project Site, determine Product conformance with specified requirements and reject Products not complying with specifications. Project Field Superintendent shall direct that non-complying Products be removed from Project Site immediately.

E. Storage of fabricated steel at Project Site is responsibility of Contractor. Material stored at Project Site shall be placed so that design loads on existing or newly constructed structures are not exceeded and members will not be distorted or otherwise damaged.

F. Protect materials from corrosion or deterioration of any kind.

G. Architect/Engineer will reject any material that has become damaged because of improper storage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Open web Steel Joists and Joist Girders: As required by the Steel Joist Institute.

B. Structural steel for supplementary framing: Bearing plates, bridging, wall anchors, etc. ASTM A36.

C. Bolts for connections: ASTM A 325.

D. Welding Materials: AWS D1.1, type per Steel Joist Institute Specifications.

E. Shop and Touch-Up Primer: SSPC-Paint 15, Type I - Red Oxide.

2.02 EXTENDED ENDS

A. Extended ends shall have a load carrying capacity at least equal to the uniform load carrying the capacity of the joists specified or as indicated on the Drawings. Provide extended ends and joist extensions as shown on drawings.

2.03 BRIDGING

A. Provide member si□es and end anchorage in accordance with the Standard Specifications unless otherwise indicated in the Drawings. Use hori□ontal and diagonal bridging as required by SJI.

PART 3 EXECUTION

3.01 FABRICATION

A. A. General: Contractor shall be responsible for errors in fabrication and for correct fitting of joists. Holes shall not be made or enlarged by burning, nor will burning of unfare holes in shop or field be permitted.

B. Joists: Join members by welding in a manner that will produce finished connection of strength required.

C. Accessories: Provide all necessary sag rods, bridging, extended ends, side wall and beam anchors, wall connectors, headers and ceiling extensions.

D. Painting: Scale, rust or other deleterious materials shall be removed from fabricated joists, bridging, anchors, etc., by SJI approved methods before shop coat of paint is applied.

3.02 ERECTION

A. General: Exercise care in handling and placing joists. Set joists to lines, levels and spacing as indicated. Execute general handling and erection in accordance with SJI Specifications. Minimum bearings and anchorage shall conform to SJI Specifications and/or Drawings. Do not start erection of joists until supporting Work is in place and connections made. Permanently fasten joists to supports and completely install all bridging and anchors before any construction loads are placed.

B. Allow for erection loads: Provide sufficient temporary bracing to maintain framing safe, plumb and in true alignment.

C. Bridging: Conform to requirements of Steel Joist Institute Standard Specifications and loads shown on the Drawings. Anchor each line of bridging to walls or supports and to each joist by

welding or bolting. Do not permit erection of decking until joists are braced bridged and secured or until completion of erection and installation of permanent bridging and bracing.

D. Welding: Execute welding in accordance with “Code for Arc and Gas Welding in Building Construction” of American Welding Society as amended to date and only by welding operators who have been previously qualified to perform the type of work required.

E. Damaged Joists: Do not use joists with cracked or improper welds or joists otherwise damaged so as to affect their structural properties. Field repair of such damaged joists will be allowed only by special permission and subject to review of the Architect. Method of repairs shall be in accordance with manufacturer’s recommendations.

3.03 CONSTRUCTION

A. Interface with Other Work:
1. Coordinate placement of anchorages in concrete and masonry construction for making connections and for securing bearing plates.
2. Furnish anchor bolts and other devices built into concrete and masonry construction to responsible installer for installation.
3. Meet with structural steel and pre-engineered metal building erector to coordinate connection requirements and scheduling for erection interface.

B. Site Tolerances:
1. Minimum Variation From Plumb: 1/4 inch.
2. Maximum Offset From True Alignment: 1/4 inch.

3.04 PAINTING

A. Fabrication Painting: Reference Paragraphs 2.1 E and 3.1 D.

B. Field Touch-Up Painting: Prepare and coat welds, fasteners, burned and abraded areas as noted under Fabrication Painting.

3.05 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements for Quality Control: Contractor Quality Control Inspector shall perform contractor quality control inspections.
1. Inspect joist installation, type, spacing and connections to structure.
2. Visually inspect all field-welded connections.
3. Document preparatory, initial and follow-up inspection in Contractor’s Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Refer to Division 1, General Requirements for Testing and Inspection Services: Perform the following.
1. Inspect shop fabrication and field fabrication and erection at all times during process of Work. Inspect all connections of both bolted and welded types.
2. Inspect erection of steel joists and joist girders for proper installation. Inspection shall include checking for proper bearing, welding, bolting and installation of bridging.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION

SECTION 053100 – METAL DECK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to installation of steel deck as described herein and/or as shown on the Drawings including type of deck, layout and orientation.
2. Welds and mechanical fastener types, sizes and patterns.
3. Supplemental framing for openings.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:
1. Section 033000 – Cast-in-Place Concrete.
2. Section 051200 – Structural Steel.
3. Section 052100 – Steel Joist Framing.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM A36 – Standard Specification for Structural Steel.
2. ASTM A611 – Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled.
3. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
4. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
6. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. American Institute of Steel and Iron (AISI):
1. North American Specification for the Design of Cold-Formed Steel Structural Members, 2004 Supplement.

C. American National Standards Institute (ANSI):
1. Safety Requirements for Powder-Actuated Fastening Systems (ANSI A10.3).

D. American Welding Society (AWS):
1. Structural Welding Code – Steel (D1.1).
2. Structural Welding Code – Sheet Steel (D1.3).
3. Standard Symbols for Welding, Brazing and Nondestructive Examination (A2.4).

E. Department of the Army, Navy and the Air Force:
1. Technical Manual – Seismic Design for Buildings (TM 5-809-10, NAVFAC P-355, AFM 88-3, Chapter 13).

F. Factory Mutual (FM):
1. Building Materials Approval Directory.
2. Standard Class No. 4450 – Class I Insulated Steel Roof Decks.

G. International Code Council Evaluation Service (ICC ES):
1. Uniform Building Code (UBC).
2. International Building Code (IBC).
3. Acceptance Criteria for Steel Decks (AC 43).
4. Steel Deck Diaphragms Attached with Hilti X-ENP-19 L15, X-EDN19-THQ12 or X-EDNK22-THQ12 Fasteners and Self-Drilling Screws, Button Punches or Top Seam Welds (ESR-2197).
5. Steel Deck Diaphragms (ESR-2199).

H. Steel Deck Institute (SDI):
1. Diaphragm Design Manual – Design Manual for Composite Decks, Form Decks and Roof Decks, Latest Edition.
2. Manual of Construction with Steel Deck.
3. Standard Practice Details.
4. Deck Damage and Penetrations.

I. Steel Joist Institute (SJI):
1. Standard Specification Load Tables and Weight Tables for Steel Joist and Joist Girders, 40th Edition.

J. Underwriters Laboratories (UL):
1. Roofing Materials and Systems Directory.
2. Fire Resistance Directory, Volume 1.
3. UL Standard 580 – Tests for Uplift Resistance of Roof Assemblies.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Provide adequate diaphragm shear resistance, uplift resistance and stiffness for imposed load combinations.

B. Performance Requirements: FM classified Class I-90 minimum for uplift resistance and UL fire classified.

1.04 SUBMITTALS

A. General: Submittals shall be in accordance with Conditions of the Contract and refer to Division 1, General Requirements, for Submittal Procedures.

B. Shop Drawings Include:
1. Deck layout and orientation, supporting steel framing and supports with dimensions and section details.
2. Deck type and profile, dimensions, supports, projections, openings and reinforcement.
3. Welds and mechanical fastener types, sizes and patterns.
4. Sidelap connector types, sizes and patterns.
5. Accessory details.

C. Design Data Includes:
1. Calculations in accordance with SDI design methods or approved alternative method verifying allowable diaphragm shears and stiffness.
2. Weld and mechanical fastener performance data including ultimate tension and shear loads and flexibility factors.

D. Assurance/Control Submittals:
1. Inspection Reports: Submit the following inspection reports directly to Architect from Independent Testing Laboratory with copy to Contractor.
a. Testing Laboratory Inspection of steel deck.
2. Fastener Inspection Reports: Submit the following inspection reports directly to Architect from fastener manufacturer Quality Control Representative with copy to Contractor.
a. Manufacturer inspection of mechanical fasteners.
3. Welders Certificates: Certify welders to AWS standards within previous twelve (12) months.
4. Qualification Documentation: Upon request, submit documentation of experience indicating compliance with specified qualification requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Steel Deck Manufacturer: Member producer of SDI.
2. Mechanical Fastener Manufacturer: Member producer of SDI and ISO 9001 accredited for manufacturing quality control.

B. Qualifications:
1. Company speciali□ing in performing the work of this Section with minimum five (5) years of documented experience.
2. Welders: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed on Work have satisfactorily passed AWS qualification tests within previous twelve (12) months.
3. Powder or Air Actuated Fastener Installers: Tool operator licensed by pin manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Steel Deck:
1. Do not rack, bend or mar steel deck sheets.
2. Store steel deck sheets and accessories above ground and protected from free weathering with one end elevated.
3. Cover and ventilate unpainted or uncoated steel deck sheets until final installation.
4. Architecturally exposed steel deck sheets shall be appropriately packaged or protected to prevent damage during delivery, storage and handling.

B. Welding Electrodes and Mechanical Fasteners:
1. Store welding electrodes, mechanical fasteners and powder-actuated boosters in original packages in a cool, dry location until final installation.
2. Comply with all project and national safety regulations regarding handling of welding equipment and powder-actuated fastening systems.

C. Sidelap Connectors:
1. Store connectors in original packages in a cool, dry location until final installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Steel Deck:
1. Vulcraft.
2. Verco Manufacturing Company.

3. Wheeling Corrugating Company.
4. Approved alternative.

B. Mechanical Fasteners:
1. Hilti, Inc.
2. Other approved alternative.

C. Sidelap Connectors:
1. Self-drilling metal screws
a. Hilti, Inc.
b. Elco Textron.
c. Other approved alternative.

2.02 MATERIALS

A. Steel Deck:
1. Decking: Indicated on Drawings.
2. Galvani□ed steel: ASTM A653 – SS Designation, Grade 33 with minimum yield strength 33 ksi.
3. Cold rolled steel:
a. ASTM A611 – Grade C with minimum yield 33 ksi.
b. ASTM A446 – Grade A with □inc coating in accordance with ASTM A525 G60.

B. Welds and Mechanical Fasteners:
1. Welds:
a. Material: Electric shielded arc process using minimum E60 XX electrodes in accordance with AWS D1.3 procedures.
b. Weld Quality: All welds uniform si□e and appearance and free of pinholes, porosity, undercutting or other defects.
c. Weld Si□e: Minimum □ inch effective diameter.
d. Weld Washers: Use on steel deck thinner than 22 gauge.
2. Mechanical Fasteners:
a. Material: AISI 1070 modified.
b. Hardness: Minimum Rockwell Hardness C 54.5.
c. Strength: Minimum tensile strength 285 ksi; minimum shear strength 175 ksi.
d. Design and Manufacture: Knurled shank with forged ballistic. Manufacturing process shall ensure steel ductility and prevent development of hydrogen embrittlement.
e. Washers:
1) For bar joist framing: Minimum 12 mm (0.472 in.) steel washers.
2) For structural steel framing: Minimum 15 mm (0.591 in.) steel washers.
f. Corrosion Resistance:
1) For steel decks with waterproofing membrane: 5 mm □inc electroplated in accordance with ASTM B633 SC1 Type III.
2) For exposed steel decks: Minimum AISI 304 stainless steel sealing caps with bonded neoprene washer shall be installed over each fastener.
g. Design Requirements:
1) SDI diaphragm shear and flexibility.
2) FM wind uplift resistance.
3) UL fire classification.
h. Approved Types:
1) For use with bar joist framing supports with top chord thickness 1/8 inch to 3/8 inch:
a) Hilti X-EDNK22 THQ12 (1/8 in. up to, but not including □ in.).

b) Hilti X-EDN19 THQ12 (greater than 3/16 in. up to and including 3/8 in.).
c) Other approved alternative.

2) For use with structural steel framing supports with top flange thickness □ inch or thicker:
a) Hilti X-ENP-19 L15 (1/4 inch or thicker).
b) Other approved alternative.

C. Sidelap Connectors:
1. Acceptable types of sidelap connectors:
a. Top or side seam welds
1) 1-1/2 inch long fillet welds in accordance with AWS D1.3 procedures.
b. Self-metal drilling screws:
1) Drive self-metal drilling screws completely through adjacent lapped deck sheets to achieve positive engagement of adjacent sheets with a minimum of three thread penetration.
2) Material: AISI 1022 modified.
3) Hardness: Minimum Rockwell Hardness B 59.5.
4) Strength: Minimum tensile strength 62 ksi; minimum yield 34 ksi.
5) Design and Manufacture: High hex washer head undercut with reverse serrations; pilot point at center.
6) Corrosion Resistance:
a) For steel decks with waterproofing membrane: 5 mm □inc electroplated in accordance with ASTM B633 SC1 Type III.
b) For exposed steel decks: AISI 410 or 304 stainless steel with bonded neoprene washer.
7) Design Requirements:
a) SDI diaphragm shear and flexibility.
b) FM wind uplift resistance.
c) UL fire classification.
8) Approved Types:
a) Hilti S-MD 10-16 x 7/8 HHWH Pilot Screw.
b) Hilti S-MD 12-14x 1 HHWH Stitch Screw.
c) Hilti S-MD 10-16 x □ HWH #3 Stainless Steel Screw.
d) Other approved alternative.
c. Button punch:
1) Button punches shall be deep and positively engage the male and female side edges of adjacent interlocking deck sheets.

2.03 ACCESSORIES

A. Weld Washers: Flat washers with thickness between 0.05 and 0.08 inches with a minimum prepunched hole of 3/8 inch diameter.

B. Verco Sheartran□II (or Sheartran□) restraining elements: ASTM A653 – SS Designation, Grade 33 with minimum yield strength 38 ksi, 16 gauge. Used with Verco HSB-36 (or HSB-36-SS) steel deck at shear collecting support elements perpendicular to the deck corrugations. Install restraining elements in accordance with manufacturer's instructions and ICC ES ESR-2199 as shown on the Drawings.

2.04 FINISHES

A. As noted on Drawings:

1. Prime Painted Finish: Acrylic primer applied to thoroughly cleaned and etched steel. Rust inhibitive primer roller applied and oven cured to thickness 4 mm nominal each side.
2. Galvani□ed Finish: Zinc coated in accordance with ASTM A525 G60 with factory prime paint coat.

PART 3 EXECUTION

3.01 3.1 INSTALLERS

A. Qualifications:
1. All steel deck welders AWS certified for welding of sheet steel.
2. All mechanical fastener installers certified or licensed by the fastener and tool system manufacturer on the project site. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.

B. Experience:
1. Minimum experience with three projects of similar si□e and type with chosen installation method.

C. Compliance:
1. Comply with all manufacturer catalog and carton installation instructions, product data and technical bulletins.

3.02 PREPARATION

A. Examination: Examine condition of supporting steel framing. Confirm location and elevation of supporting steel framing with the Drawings.

B. Layout: Place steel deck sheets as shown on the Drawings ensuring bearing on supporting steel framing. Sheets shall be true and straight with hori□ontal deviations less than 1/4 inch in 100 feet. Minimum endlaps 2 inches.

C. Marking: Mark steel deck at the centerline of supporting steel members to prevent weld burn through and mechanical fastener punch through. Use a chalk line or indelible marker.

D. Test Fastenings:
1. Welds: Perform project specific test welds prior to final installation. Test welds are considered an example of representative work.
2. Mechanical fasteners: Gauge pneumatic or powder actuated tool systems to the base material steel type and deck type and thickness prior to final installation. Confirm appropriate power regulation, powder actuated booster load and compressor air pressure prior to final installation.

3.03 INSTALLATION

A. Install steel deck sheets and accessories in accordance with manufacturer’s instructions and as shown on the Drawings.

B. Secure steel deck to supporting steel framing with welds or mechanical fasteners. Install welds or mechanical fasteners at the spacing and pattern as shown on the Drawings.

C. Secure steel deck sidelaps at the spacing and pattern as shown on the Drawings.

D. End closures of the deck units shall be fastened by tack welding or sheet metal screws not more than 48 inches apart.

E. Where deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

F. Immediately after welding deck and other metal components in position, coat welds, burned areas and damaged surface coating, with touch-up primer.

G. Position drain pans with flange bearing on top surface of deck. Weld at each deck flute.

3.04 REPAIR / RESTORATION

A. Welds: Repair all portions of the steel deck coating damaged due to weld heat with compatible paint type or □inc rich compound. Repair burn throughs in accordance with SDI Deck Damage and Penetrations.

B. Mechanical Fasteners: Replace or supplement underdriven and over driven fasteners with adjacent, properly installed fasteners.

3.05 OPENINGS

A. At deck openings provide steel angle reinforcement indicated on Drawings. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and weld to deck at each flute.

B. At openings between deck and walls, columns and openings, provide sheet steel closures and angle flashings to close openings.

3.06 HANGING LOADS

A. Mechanical equipment or other loads shall not be hung from metal deck unless specifically indicated and detailed on Drawings. Method of attachment subject to review by Architect and Engineer.

3.07 FIELD QUALITY CONTROL

A. Welds: Examination and qualification of puddle and fillet welds shall be in accordance with AWS D1.3 criteria.

B. Mechanical Fasteners: Examine fastener washers to ensure steel deck is clamped to the supporting steel framing. Periodically examine fastener nail head standoff with template or gauge to within manufacturer accepted tolerances.

C. Quality Control: Contractor Quality Control Representative shall perform contractor quality control inspections.
   1. Inspect steel deck installation, layout, types, gauge, finish and si□es of decking sheets, connections and tolerances, and welding.
   2. Document preparatory, initial and follow-up inspection in Contractor’s Test and Inspection Reports.
   3. Test and Inspection Reports shall be available to Architect upon request.

3.08 SAFETY

A. Do not use steel deck sheets for storage or working platform until permanently fastened to supporting steel framing.

B. Do not exceed construction load carrying capacity of steel deck sheets for type and span defined in SDI Construction Load Tables.

C. Cordon off the Controlled Decking Zone (CDZ) area and all areas below steel deck sheets being fastened during installation.

END OF SECTION 053100

SECTION 054100 – COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to installation of Load bearing formed steel stud framing, 20 gage and heavier as described herein and/or as shown on the Drawings.
2. Exterior wall framing.
3. Formed steel joist framing.

B. B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
1. Section 051200 – Structural Steel.
2. Section 055000 – Metal Fabrications.
3. Division 7, Thermal Protection – Blanket Insulation: Insulation within framing members.
4. Division 9, Finishes – Plaster and Gypsum Board Assemblies: Gypsum Wall Assemblies.
5. Division 9, Finishes – Supports for Plaster and Gypsum Board: Non-Structural metal framing.
6. Division 13, Special Construction – Pre-Engineered Metal Buildings: Building structural frame and metal wall panels.

1.02 REFERENCES

A. American Iron and Steel Institute (AISI):
1. AISI SG-971 – Specification for Design of Cold-Formed Steel Structural Members.

B. American Society for Testing and Materials (ASTM):
1. ASTM A 307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
2. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvani□ed Coatings.
3. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic-and Nonmetallic-Coated for Cold-Formed Framing Members.
4. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
5. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
6. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
7. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

C. American Welding Society (AWS):
1. AWS D1.3 – Structural Welding Code – Sheet Steel.

1.03 SYSTEM DESCRIPTION

A. Component Design: Comply with AISI Specification for Design of Cold Formed Steel Structural Members, latest edition.

B. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic, day and night, temperature ranges.

C. Maximum Allowable Deflection: 1/360 for non-masonry finishes and 1/600 for masonry finish.

D. Design system to accommodate construction tolerances, deflections of building structural members, and clearances of intended openings.

1.04 SUBMITTALS

A. Shop Drawings:
1. Submit shop drawings for components and installations not fully dimensioned or detailed in manufacturer's product data.
2. Include placing drawings for framing members showing size and gage designations, number, type, location, and spacing.
3. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for installation.
4. Indicate welded connections.

B. Product Data: Submit data on standard framing members; describe materials and finish, and product criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in structural framing and components of this section with five (5) years minimum documented experience.

1.06 PRODUCT HANDLING

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Metal Framing:
1. United Steel Systems.
2. Clark Dietrich Building Systems.
3. Unimast Incorporated.
4. Dale/Incor.

B. Wall or Partition Floor Track Anchorage Devices:
1. Hilti, Incorporated.
2. Simpson Anchor Systems.
3. Powers Fastening, Incorporated.

2.02 MATERIALS

A. A. Studs, Joists and Track: ASTM A 1003, ASTM C 955.
   1. Gage and Depth: Indicated on Drawings.
      a. Studs: Steel formed to channel shape with punched web; U-shaped track in matching nominal width and compatible height.
      b. Joists: Formed steel to channel shape, solid web.
      c. Track: Formed sheet steel; channel shaped; same width as studs, tight fit, solid web.
   2. Galvani□ed Coating: G60 minimum.

B. Bracing, Furring, and Bridging: Formed sheet steel, thickness determined for conditions encountered, finish to match framing components.

C. Plates, Gussets, and Clip Angles: Formed sheet steel, thickness determined for conditions encountered, finish to match framing components.

D. Headers: Use Joists; quantity and alignment as indicated on drawings. Finish to match framing components.

E. Touch-Up Primer for Galvani□ed Surfaces: ASTM A 780, □inc-rich primer.

F. Fasteners:
   1. Screws: Self-drilling, self-tapping screws; steel, complying with ASTM C 1002; galvani□ed coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.
   2. Interior Wall and Partition Floor Track Anchorage Device at Concrete Slabs: Low velocity powder-actuated drive pins; minimum 0.140 inch shank diameter x 1-1/2 inch shank length with steel washer.
   3. Anchor Bolts for Exterior Walls: ASTM A 307, Grade C.
   4. Welding: In conformance with AWS D1.3.

G. Exterior Wall Sill Plate Sealer Strip:
   1. Manufacturer: Protecto Wrap.
   2. Product: Protecto Premium Energy Sill Sealer.
   3. Description: 3/8 inch closed cell polyethylene foam with self adhesive waterproof membrane, air, moisture and insect barrier sill sealer.

2.03 FABRICATION

A. Fabricate panels plumb, square, and true to line.

B. Fabricate assemblies of framed sections of si□es and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

D. Cut all framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until properly fastened.

E. Provide insulation as specified elsewhere in all double jamb studs and double header members, which will not be accessible to the insulation contractor.

F. Axially Loaded Studs:
   1. Install studs to have full bearing against inside track web (1/16 inches maximum gap) prior to stud and track attachment.
   2. Splices in axially loaded studs are not permitted.

G. Fasteners: Fasten components using self-tapping screws or welding.

H. Anchorage to Slab: Anchor floor tracks and runners to concrete with anchor bolts or powder actuated drive pins.

I. Perform lifting of prefabricated panels in manner to prevent damage or distortion. Framing components may be prefabricated into panels prior to erection.

J. Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

K. Welding: Welding permitted on 18 gage or heavier material only.
1. Specify welding configuration and size on the Structural Calculation submittal.
2. Qualify welding operators in accordance with Section 6.0 of AWS D.1.3.
3. Touch up all welds with zinc-rich paint in compliance with ASTM A 780.

L. Wire tying of framing components is not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Division 1, General Requirements – Execution for additional requirements on the Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 INSTALLATION

A. Install metal framing systems in accordance with requirements of ASTM C1007 and manufacturer's printed instruction and recommendations.

B. Runner Tracks:
1. Install continuous tracks sized to match studs.
2. Align floor and ceiling tracks accurately to layout at base and tops of studs.
3. Secure in place with anchor bolts or powder actuated fasteners.
4. Provide fasteners at corners and ends of tracks.
5. Provide deflection allowance in stud track, directly below horizontal building framing for non load bearing framing.

C. Installation of Wall Stud System:
1. Set studs plumb, except as needed for diagonal bracing or required for non plumb walls or warped surfaces and similar requirements.
2. Secure studs to top and bottom runner tracks at both inside and outside flanges.
3. Place studs at spacing indicated on Drawings; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using connection screws per manufacturer's recommendations.

4. Frame both sides of expansion and control joints, with separate studs; do not bridge joint with components of stud system.
5. Erect studs one piece full length; splicing of studs is not permitted.
6. Brace and reinforce to develop full strength to meet design requirements.
7. Construct corners using minimum of three studs; minimum double stud at wall opening, door, and window jambs.
8. Frame wall openings larger than 2' 0" square with double stud at each jamb of frame except where more than two are either shown or recommended by manufacturer.
9. Install runner tracks and jack studs above and below wall openings.
10. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full height studs of wall.
11. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
12. Secure stud system all around to wall opening frame.
13. Install hori□ontal stiffeners in stud system, spaced at not more than 4' 6" o.c. Weld at each intersection.
14. Touch-up damaged galvani□ed surfaces with primer.

D. Installation of Joists.
1. Make provisions for erection stresses. Provide temporary alignment and bracing.
2. Place joists at spacing indicated on Drawings; not more than 2 inches from abutting walls. Connect joists to supports using method indicated on Drawings.
3. Set joists parallel and level, with lateral bracing and bridging.
4. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
5. Provide web stiffeners at reaction points.
6. Touch-up field welds and damaged galvani□ed surfaces with primer.

E. Support of wall hung equipment:
1. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, heavy trim, furnishings, and similar work requiring attachment to wall or partition. Comply with stud manufacturer's recommendations for supplementary support, considering weight or loading resulting from item supported.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements - Quality Control: Contractor Quality Control Representative shall perform contractor quality control inspections.
1. Inspect metal framing installation, stud type, gage, spacing, fasteners and connections.
2. Document preparatory, initial and follow-up inspection in Contractor’s Test and Inspection Reports.
3. Test and Inspection Reports shall be available to Architect upon request.

B. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 054100

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SECTION 055000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items, including:

B. Miscellaneous metal angles

C. Miscellaneous metal angles & framing for masonry & mechanical / electrical equipment

D. Metal ladders

E. Metal Handrailing

F. Loose Steel lintels

G. Pipe bollards

H. Anchorbolts, pipe sleeves, inserts, Weld plates and other applications as required.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 053100 - Metal Deck: Bearing plates for metal deck bearing, including anchorage.

C. Section 055133 - Metal Ladders.

D. Section 055213 - Pipe and Tube Railings.

E. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

I. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing 2021.

J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

K. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

N. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

P. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).

Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

S. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

T. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.05 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Stainless Steel, General: ASTM A666, Type 304.

F. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.

G. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

H. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

I. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed on the Drawings; prime paint finish.
   1. Provide Polyethylene bollard cover equal to : Seton Flat Top Bollard Cover with reflective tape on top of sleeve, 6" pipe bollard. Marlex HHM 5502 BN High Density Polyethylene. Color selection will be from full range of colors and full range of reflective tape color. Seton contact information: Phone 877-367-7732, submittals@seton.com.

B. Hangers: Strap anchors, fabricated with sheet steel, 18 gauge, 0.0478 inch minimum base metal thickness; galvanized finish.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; grey prime paint finish.

D. Lintels: As detailed; galvanized finish.

2.05 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
   1. Configuration: Angular.
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.

2.06 STEEL LADDERS

A. Space Siderails 18" apart unless otherwise indicated

B. Siderails: Continious, 3/8" X 2 1/2" steel flat bars, with eased edges.

C. Rungs: 3/4" steel bars.

D. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60" o.c. with welded or bolted steel brackets.

F. Prime ladders, including brackets and fasteners with grey oxide primer.

G. Provide non-slip surface on top of each rung.

H. Reference Steel Ladder detail A706-01

2.07 LOOSE STEEL LINTELS

A. Steel Lintels:
   1. Fabricate loose steel lintels from steel angles and shapes of sizes indicated for openings, cast stone and recesses in walls and partitions at locations indicated on drawings.
   2. Fabricate in single lengths for each opening unless otherwise indicated.
   3. Weld adjoining members together to form a single unit where indicated.
   4. Size loose lintels to provide bearing length at each side of opening equal to 1/12 of clear span, but not less than 8" unless otherwise indicated.
   5. Galvanize loose steel lintels located in exterior walls.

2.08 STEEL WELD PLATES AND ANGLES

A. Weld Plates and Angles:
   1. Provide steel weld plates and angles not specified in other sections
   2. Provide items supported for concrete construction needed to complete the work.
   3. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.09 CAST IRON TRENCH CASTINGS

A. Cast Iron Trench Castings:
   1. Material: Cast iron; ASTM A48/A48M, Class 35 B (heavy duty).
   2. Grate Type: Manufacturer's standard Type A.

2.10 FINISHES - STEEL

A. Prime paint (grey primer) steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

G. Stainless Steel Finish: No. 4 Bright Polished finish.

2.11 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Pre-manufactured Stairs with grating treads - Ships Ladder

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

E. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NAAMM AMP 510 - Metal Stairs Manual 1992.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS D1.1 / D1.1M and dated no more than 12 months before start of scheduled welding work.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Texas, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Prefabricated Metal Stairs: Shipps Stair
   1. Precision Ladders, LLC; Aluminum Ship Stairs SL-02: www.precisionladders.com/#sle. 2'10" wide X 12'-10" height to Mezzanine - Field Verify Angle (assumed 63 deg) with walk-thru for mezzanine access

2.02 PREFABRICATED SHIP STAIRS WITH WALK-THRU

A. Prefabricated Aluminum Stairs: Welded unit, factory fabricated to greatest degree practical and in the largest components possible.
   1. Design Requirements: Comply with structural design criteria stated elsewhere in this section and applicable local code.
      a. Comply with applicable sections of the IBC.
   2. Materials: Manufacturer's standard aluminum tubes, plates, bars, shapes, sheets, wire and mesh that comply with requirements of MATERIALS article of this section.
      a. Rails: Manufacturer's standard rails. FOR WALK-THRU TO MEZZANINE
         1) Guardrails: 42 inches high.
      b. Treads: Manufacturer's standard grip tread.
      c. Finish: Mill finish.
   3. Manufacturers:
      a. Precision Ladders, LLC; Fixed Aluminum Industrial Stairway: www.precisionladders.com/#sle. SL-02

2.03 HANDRAILS AND GUARDS

A. Hand Rails:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
   2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair continuous with sloped rails
      a. Outside Diameter: 1 inch.
      b. Jointing: Welded and ground smooth and flush.
   3. End and Intermediate Posts: Same material and size as top rails.
      a. Horizontal Spacing: As indicated on drawings.
      b. Mounting: Welded to top surface of stringer.

2.04 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.05 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified grey shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC - SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning.
   2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and in place construction with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, and hangers required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 055100

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SECTION 055133 - METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 055213 - Pipe and Tube Railings.

B. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders current edition.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

I. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.05 QUALITY ASSURANCE

A. Design under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

F. Bolts, Nuts, and Washers: ASTM A307, plain.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 by 2 inches members spaced at 20 inches.
   2. Rungs: One inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.

2.04 FINISHES - STEEL

A. Prime paint steel items. - Gray color.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION 055133

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SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Ramp railings and guardrails.

C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

G. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings: Reference Metal Fabrications

B. Metal Rail Infill:
   1. The Western Group; Woven Wire: www.architecturalwire.com/#sle.

C. Accessibility-Compliant Handrail Brackets:

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
2. Intermediate Rails: 1-1/2 inches diameter, round.
3. Posts: 1-1/2 inches diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
1. For anchorage to stud walls, provide backing plates, for bolting anchors.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

H. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
1. Ease exposed edges to a small uniform radius.
2. Welded Joints:
a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

2.03 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 40 primed for painting

C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

E. Exposed Fasteners: No exposed bolts or screws.

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055213

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SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.

B. Sheathing.

C. Subflooring.

D. Roof-mounted curbs.

E. Roofing nailers.

F. Roofing cant strips.

G. Miscellaneous framing and sheathing.

H. Communications and electrical room mounting boards.

I. Concealed wood blocking, nailers, and supports.

J. Miscellaneous wood nailers and furrings.

1.02 RELATED REQUIREMENTS

A. Section 072700 - Air Barriers: Air barrier over sheathing.

B. Section 076200 - Sheet Metal Flashing and Trim: Sill flashings.

C. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

D. Section 313116 - Termite Control: Field-applied termiticide and mildewcide for wood materials.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard 2016.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

E. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

G. AWPA U1 - Use Category System: User Specification for Treated Wood 2021.

H. PS 1 - Structural Plywood 2009 (Revised 2019).

I. PS 2 - Performance Standard for Wood Structural Panels 2018.

J. PS 20 - American Softwood Lumber Standard 2021.

K. SPIB (GR) - Grading Rules 2014.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing (2 by 2 through 2 by 6):
   1. Grade: No. 2.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings.

C. Surfacing: S4S.

D. Moisture Content: S-dry or MC19.

E. Stud Framing (2 by 2 through 2 by 6):
1. Species: Western Cedar.
2. Grade: Clear.

2.04 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

2.05 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: PS 2 type, rated Single Floor.
1. Bond Classification:
2. Span Rating: 48.
3. Performance Category: 1-1/8 PERF CAT.
4. Edges: Tongue and groove.

B. Underlayment: Particleboard, ANSI A208.1, Grade PBU.

C. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
1. Bond Classification: Exterior.
2. Span Rating: 60.
3. Performance Category: 3/4 PERF CAT.

D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Sill Flashing: See Section 076200.

C. Subfloor Adhesives: Gap-filling construction adhesive for bonding wood structural panels to wood-based floor system framing; complying with ASTM D3498.

D. General Purpose Construction Adhesives: Comply with ASTM C557.
1. Products:

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 EXECUTION

3.01 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific nonstructural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Underlayment: Secure to subflooring with nails and glue.
1. Place building paper between floor underlayment and subflooring.

C. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. Nail panels to framing; staples are not permitted.

D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.

3. Install adjacent boards without gaps.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.08 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

3.09 CLEANING

A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.
1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

END OF SECTION 061000

SECTION 062000 - FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items - trim, handrails, chair rails

B. Door & Window trim.

C. Wood casings and moldings.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 099000 - Painting and Coating - Commercial Facility Guide Specification : Painting of finish carpentry items.

D. Section 099300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. BHMA A156.9 - Cabinet Hardware 2020.

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

D. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scaled Drawings:

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Exterior Woodwork Items: - Reference Wood Siding

C. Interior Woodwork Items:
1. Moldings, Bases, Casings, and Miscellaneous Trim: Birch ; prepare for stain and seal finish.
2. Window Sills: Solid Surface as specified with plywood backing
3. Loose Shelving: Poplar plywood; prepare for paint finish.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: Birch species for Trim where specified, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.

2.03 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, ; PS 1 Grade A-B, glue type as recommended for application.

B. Hardwood Plywood: Face species as indicated, plain sawn, book matched, ; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.04 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; color as selected by Architect; textured, low gloss finish from full range of colors - solids, wood or prints.

B. Low Pressure Laminate: Melamine; interiors or "non-exposed" color to be selected from full range of standard colors

C. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

D. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.05 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

C. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Lumber for Shimming and Blocking: Softwood lumber of Poplar species.

C. Primer: Alkyd primer sealer.

D. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Shelf Standards: Heavy Duty style, 612 finish.

C. Shelf Brackets: Heavy Duty style, 612 finish.

D. Concealed Standard Shelf, Countertop, and Workstation Brackets:
1. Material: Steel.
    a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
    b. Color: Black.
    c. Height: 5 inches.
    d. Support Length: 8 inches.

E. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
1. Material: Steel; T-shape cross-section.
    a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
    b. Color: Black.
    c. Height: 9 inches.
    d. Support Length: 9 inches.
    e. Width: 1 inch.

F. Texas Accessibility Standards / Americans with Disabilities Act (ADA)-Compliant Vanity and Countertop Brackets:
1. Material: Steel; formed compound shapes.
    a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
    b. Color: Black.
2. Height: Reference Interior Elevations for specific counter heights for each unit.

G. Countertop Brackets: Fixed, L-shaped, top of knee wall mounting.
1. Material: Steel plates.
2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
3. Color: Black.
4. Height: 6 inches.
5. Support Length: 6 inches.
6. Plate Thickness and Width: 3/8 inch by 2-1/2 inches.

H. Vanity Brackets: Fixed, cantilevered support leg, face-of-stud mounting.
1. Materials: Steel L-shapes.
2. Color: Black.

2.08 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Wood Preservative (Surface Application): Clear.

C. Redry wood after pressure treatment.

2.09 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: Comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Finishing: Field finished as specified in Finish Schedule.

2.10 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

E. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

F. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.11 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
1. Transparent:
a. System - 1, Lacquer, Nitrocellulose.
b. Stain: As selected by Architect.
c. Sheen: Flat.

E. Stain, seal, and varnish exposed to view surfaces.

F. Seal internal surfaces and semi-concealed surfaces.

G. Prime paint surfaces in contact with cementitious materials.

H. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components with Screws.

E. Install prefinished paneling with full bed contact adhesive applied to substrate.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 099113 and 099123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 062000

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SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 099000 - Painting and Staining Coating: Field finishing of cabinet exterior.

C. Section 123600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. BHMA A156.9 - Cabinet Hardware 2020.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

E. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.04 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scaled Drawings

B. Product Data: Provide data for hardware accessories.

C. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Single Source Responsibility: Provide and install this work from single fabricator.

1.06 MOCK-UPS

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:
1. Exposed Surfaces: HPVA HP-1 Grade A, Birch, plain sliced, random-matched.
2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Birch, plain sliced, random-matched.
3. Concealed Surfaces: Manufacturer's option.

C. Plastic Laminate Faced Cabinets: Custom grade.

D. Cabinets:
1. Finish - Exposed Exterior Surfaces: Decorative laminate.
2. Finish - Exposed Interior Surfaces: Decorative laminate.
3. Finish - Semi-Exposed Surfaces: Decorative laminate
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square Edge.
6. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
   a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
7. Cabinet Design Series: As indicated on drawings.
8. Adjustable Shelf Loading: 100 psf.
9. Cabinet Style: Flush overlay.
10. Cabinet Doors and Drawer Fronts: Flush style.
11. Drawer Side Construction: Multiple-dovetailed.
12. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS

A. Manufacturers:
1. Formica Corporation: www.formica.com/#sle.
2. Wilsonart LLC: www.wilsonart.com/#sle.

B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.04 COUNTERTOPS

A. Countertops: See Section 123600.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's standard range.
2. Use at all exposed plywood edges.
3. Use at all exposed shelf edges.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Adjustable Drawer Organization Systems: Drawer trays, dividers, and connectors.- Extra Heavy duty application on all drawer slides.

G. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Fixed Specialty Shelf Supports:
1. Material: Steel.
2. Color: Black.

D. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
1. Materials: Steel plates.

E. Vanity Brackets: Fixed, ADA-compliant, face-of-stud mounting.
1. Material and Shape: Steel; formed compound shapes.
a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
b. Color: Black.

F. Countertop Brackets; L-shaped, top of knee wall mounting.
1. Materials: Steel plates.
2. Finish: Manufacturer's standard, factory-applied, powder coat.
3. Color: Black.
4. Height: 6 inches.

5. Support Length: 6 inches.
6. Plate Thickness and Width: 3/8 inch by 2-1/2 inches.

G. Vanity Brackets: Cantilevered support legs with wall header, face-of-wall mounting.
1. Materials: Steel angles.
2. Finish: Manufacturer's standard, factory-applied, powder coat.
3. Color: Black.
4. Width: 20 inches.
5. Support Length: 6 inches.

H. Drawer and Door Pulls: "U" shaped wire pulls, with 4" centers - Finish to match door hardware - verify.

I. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, bronze with satin finish.

J. Cabinet Catches and Latches:
1. Type: Friction catch.

K. Drawer Slides:
1. Type: Extension types as indicated.
2. Static Load Capacity: Extra Heavy Duty grade.
3. Mounting: Side mounted.

L. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

M. Pull Up Cabinet Door Supports: Surface-mounted; 612 Bronze finish. match door hardware finish - verify

N. Television and Monitor Support Slides:

O. Hooks: Surface-mounted; stainless steel, satin finish.

2.07 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Finishing: Field finished as specified in 099300Finish Schedule.

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

C. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Stain: As selected by Architect.
      b. Sheen: Flat.
   2. Opaque:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Color: As selected by Architect.
      c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 064100

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SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in exterior wall, ceiling, and roof construction.

B. Batt insulation for filling crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation on Inside of Framed Walls with Exposed Facer Providing Interior Finish: Rigid cellular polyisocyanurate with exposed facers.

B. Insulation in Metal Framed Walls: Batt insulation with separate vapor retarder.

C. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit fill cavity with thickness of stud
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   2. Thickness: As required to fill wall stud width, or as shown on drawings and above ceilings provide 3 1/2" batts cut to fit ceiling tile spacing/
   3. Products:
      a. CertainTeed Corporation: www.certainteed.com/#sle.
      b. Johns Manville: www.jm.com/#sle.
      c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

2.03 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
   1. Application: Sealing of interior circular penetrations, such as pipes or cables.
   2. Width: Are required for application.

B. Flashing Tape: Special reinforced film with high performance adhesive.
   1. Application: Window and door opening flashing tape.
   2. Width: As required for application.

C. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

D. Tape joints of rigid insulation and sheathing in accordance with insulation manufacturers' instructions.

E. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

F. Adhesive: Type recommended by insulation manufacturer for application.

G. Adhesive: Gun grade, interior and exterior, and compatible with insulation and substrates; complies with ASTM C557.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Tape insulation batts in place.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

H. Tape seal tears or cuts in vapor retarder.

I. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:
   1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).
   2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 072100

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SECTION 072400 - EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating EIFS system (Class PB) Equal to Dryvit Outsulation Plus system.

B. Reference Exterior Elevations for control joints and rustification joints and tooling in the EIFS surface.

C. Drainage and water-resistive barriers behind insulation board.

D. Heavy Duty Reinforcing Mesh - 20 oz.

1.02 RELATED REQUIREMENTS

A. Section 076200 - Sheet Metal Flashing and Trim: Perimeter flashings.

B. Section 079200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.

C. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage 2013 (Reapproved 2019).

D. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity 2015 (Reapproved 2020).

E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

F. ASTM E1677 - Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls 2019.

G. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies 2018.

H. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS) 2022.

I. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems 2009, with Editorial Revision (2014).

J. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies 2009, with Editorial Revision (2012).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

C. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles - reference exterior elevations for joint, tooling and rustification locations.

D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.

F. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

1.05 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.

1.06 MOCK-UPS

A. Construct color matching mock-up of typical EIFS application for size and pattern as indicated on drawings, and including flashings, joints, and edge conditions, rustification joints and tooling.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Store materials as directed by manufacturer's written instructions.
1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.

1.08 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. Dryvit Systems, Inc; Dryvit Outsulation Plus EIFS, Class PB: www.dryvit.com/#sle.

2.02 EXTERIOR INSULATION AND FINISH SYSTEM

A. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on flat-backed insulation board adhesive-applied directly to water-resistive coating over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples. Building wrap mechanically attached to the substrate will not be allowed. Water barrier must be fluid applied to complete the full system.

B. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.
   2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
   3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

C. Adhesion of Water-Resistive Coating to Substrate: For each combination of coating and substrate, minimum flatwise tensile bond strength of 15 psi, when tested in accordance with ASTM C297/C297M. Mechanically attached building wrap is not acceptable.

D. Adhesion to Water-Resistive Coating: For each combination of insulation board and substrate, when tested in accordance with ASTM C297/C297M, maximum adhesive failure of 25 percent unless flatwise tensile bond strength exceeds 15 psi in all samples.

E. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

F. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.

G. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.

H. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

I. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

J. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.

K. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:

1. Standard: 25 to 49 in-lb, for areas not indicated as requiring higher impact resistance.
2. Ultra-High: Over 150 in-lb, for all lower wall areas up to 9' above finished grade.

2.03 MATERIALS

A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
   1. Texture: Dryvit Systems, Inc, Standard Textures, with Dirt Pickup Resistance; Quarzputz DPR or a standard texture including sand pebble, sand pebble fine, or freestyle; www.dryvit.com/#sle.
   2. Color: As selected by Architect from manufacturer's standard range.

B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh, Class PB up to a 9'-0 height.

C. Heavy Duty Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating full height.

D. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
   1. Grooved Board: Back side of board adjacent to sheathing grooved with vertical channels designed to allow moisture to drain; at drainage points provide board configuration that permits drainage to the exterior.
   2. Board Size: 24 by 48 inches.
   3. Board Size Tolerance: Plus/minus 1/16 inch from square and dimension.
   4. Board Thickness: 1 inches, and as indicated on drawings for special shapes.
   5. Board Edges: Square.
   6. Type and Thermal Resistance, R-value (RSI-value): Type XI, 3.1 (0.55) per 1 inch thickness at 75 degrees F mean temperature using ASTM C177 test method.

E. Combination Drainage Layer/Water-Resistive Barrier: Air- and water-resistive sheet complying with ASTM E1677 Type I, grooved - troweled or otherwise profiled to maintain air and drainage space between insulation board and sheathing; minimum water vapor permeance of 20 perms; furnished by or approved by EIFS manufacturer. - Mechanically attached house wrap Water Barrier will not be approved. Water barrier must be fluid applied.

F. If combination drainage and water resistant barrier are not provided, Fluid applied water barrier must be provided in combination with a Drainage Layer or Spacers: Furnished or approved by EIFS manufacturer; capable of achieving specified drainage rate; not required to be water-resistive, air retarder, or vapor retarder.

G. Optional Drainage Mat for Drainage layer with geotextile filter fabric applied over fluid applied water-resistive barrier on sidewall sheathing as a total system may be submitted as a substitution with test data for compliance.

H. Fluid-Applied Flashing: Flexible water based polymer material suitable for use with reinforcing mesh and, if used with water-resistive barrier sheet, certified compatible with sheet material.

I. Flashing Tape: Self-adhering rubberized asphalt tape with polyethylene backing or other material and surface conditioner furnished or approved by EIFS manufacturer.

2.04 ACCESSORIES

A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.

B. Insulation Fasteners: Fastener and plate system appropriate for substrate and as recommended by EIFS manufacturer.

C. Metal Flashings: See Section 076200.

D. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.

E. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

F. Exterior Soffit Vents: One piece, perforated, ASTM A653/A653M galvanized steel with G90 coating, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

B. If paper-faced gypsum sheathing has been exposed to weather for more than 30 days, check for integrity of surface using method specified in ASTM C1397 Annex A2, at minimum of two locations or once every 5000 sq ft, whichever is greater; if any test fails, notify Architect and do not begin installation.

C. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.02 PREPARATION

A. Install over solid substrates that are deemed acceptable to receive adhesively applied insulation. Install in accordance with ASTM C1063, except for butt-lapping instead of overlapping.
   1. Attach to concrete and concrete masonry using corrosion-resistant power or powder actuated fasteners or hardened concrete stub nails not less than 3/4 inch long and with heads not less than 3/8 inch wide. Ensure that fasteners are securely attached to substrate and spaced at maximum 16 inches on center horizontally and 7 inches vertically.

B. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

3.03 INSTALLATION - GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
   1. Where different requirements appear in either document, comply with the most stringent.
   2. Neither of these documents supersedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

3.04 INSTALLATION - WATER-RESISTIVE BARRIER

A. Apply barrier coating as recommended by coating manufacturer; prime substrate as required before application.

B. Mechanically attach sheet materials to substrate using fasteners and fastener spacing recommended by EIFS manufacturer.

C. Seal substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.

D. At door and window rough openings and other wall penetrations, seal water-resistive barrier and flexible flashings to rough opening before installation of metal flashings, sills, or frames, using method recommended by manufacturer.

E. At moving expansion joints, apply flexible flashing or flashing tape across and recessed into joint with U-loop forming continuous barrier but allowing movement.

F. Lap flexible flashing or flashing tape at least 2 inches on each side of joint or transition.

G. Install drainage layer or spacers after flashing tape has been completed.

H. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.05 INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Prior to installation of boards, install starter track and other trim level and plumb and securely fastened. Install only in full lengths, to minimize moisture intrusion; cut horizontal trim tight to vertical trim.

C. Install back wrap reinforcing mesh at all openings, corners and terminations that are not to be protected with trim.

D. On wall surfaces, install boards horizontally.

E. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

F. Fill gaps greater than 1/16 inch with strips or shims cut from the same insulation material.

G. Rasp irregularities off surface of installed insulation board.

H. Adhesive Attachment: Use method required by manufacturer to achieve drainage efficiency specified; do not close up drainage channels when placing insulation board.

3.06 INSTALLATION - CLASS PB FINISH

A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
   1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
   2. Allow base coat to dry a minimum of 24 hours before next coating application.

B. At locations indicated, install second layer of reinforcing mesh embedded in second coat of base coating, tightly butting ends and edges of mesh.

C. Install expansion and control joints at lines indicated on exterior elevations and as recommended by EIFS manufacturer, but not less than 30' in any direction. Provide Rustification lines as shown on drawings.

D. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

E. Finish Coat Thickness: As recommended by manufacturer, and at a minimum of 1/16".

F. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers. Caulk vertical joints against existing masonry or adjacent construction materials.

G. Install Heavy Duty Reinforcing Mesh - 20 ounce minimum weight: Install in strict accordance with manufacturer's instructions, using fasteners as required by manufacturer. Lap reinforcing mesh edges and ends at a minimum of 2" in any direction. Provide reinforcing mesh from finished floor to a minimum height of

3.07 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.08 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION 072400

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SECTION 072500 - WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive barriers.

1.02 RELATED REQUIREMENTS

A. Section 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 DEFINITIONS

A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Water-Resistive Barrier: A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

1.04 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

C. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay 2017 (Reapproved 2021).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

F. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies 2018.

G. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016, with Editorial Revision (2019).

H. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials 2017.

I. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015.

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2019.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Mock-up may remain as part of work.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 WATER-RESISTIVE BARRIER MATERIALS

A. Water-Resistive Barrier: For use in Construction Types I, II, III, and IV on buildings greater than 40 feet in height.
   1. Comply with NFPA 285 wall assembly requirements in accordance with local building code and authorities having jurisdiction (AHJ).

B. Water-Resistive Barrier Coating: Fluid applied, UV-resistant coating for use over various types of exterior sheathing, CMU, and precast concrete in accordance with ICC-ES AC212.
   1. Dry Film Thickness (DFT): 45 mils,, minimum.
   2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method.
   3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 120 days of weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
   5. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
   6. Joint Preparation Treatment: As recommended by coating manufacturer.
   7. Products:
      a. WR Meadows Air-Shiled Liquid Membrane air/apor and liquid Moisture barrier
      b. PROSOCO, Inc. www.prosoco.com/#sle.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

B. Primer: Liquid applied polymer.
   1. Color: Black.

C. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Width: 4 inches.
   2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.

D. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable liquid flashing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Water-Resistive Barriers: Install continuous water-resistive barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Self-Adhered Sheets:
   1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle-fashion to shed water and seal laps airtight.
   3. Upon placement of sheets, firmly press onto substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
   5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.

E. Coatings:
   1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Where exterior masonry veneer is being applied, install masonry anchors prior to placement of water-resistive barrier over masonry substrate; seal airtight around anchors.
   3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch along coating seams, rough cuts, and as recommended by manufacturer.
   4. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.

F. Openings and Penetrations in Exterior Water-Resistive Barriers:

1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Do not cover installed water-resistive barriers until required inspections have been completed.

C. Obtain approval of installation procedures from water-resistive barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

D. Take digital photographs of each portion of installation prior to covering up weather barriers.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072500

SECTION 075400 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mechanically attached system with Thermoplastic Fleece back roofing membrane TPO .

B. Insulation, tapered.

C. Cover boards.

D. Flashings.

E. Roofing cant strips, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 053100 - Steel Decking: Placement of acoustical insulation for deck flutes.

B. Section 061000 - Rough Carpentry: Wood nailers and curbs.

C. Section 076200 - Sheet Metal Flashing and Trim: Counterflashings and reglets.

D. Section 077200 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2022.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022.

D. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2021.

E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing 2021.

F. FM (AG) - FM Approval Guide current edition.

G. FM DS 1-28 - Wind Design 2016.

H. NRCA (RM) - The NRCA Roofing Manual 2022.

I. NRCA (WM) - The NRCA Waterproofing Manual 2021.

J. SPRI RP-4 - Wind Design Standard for Ballasted Single-Ply Roofing Systems 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, surfacing, and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions and conditions of interface with other materials.

D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

E. Manufacturer's qualification statement.

F. Warranty Documentation:
1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Verify Existing Roof Warranty and Compatibility with existing roof warranty and materials.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
   1. Carlisle SynTec Systems; Sure-Weld TPO: www.carlisle-syntec.com/#sle.
   2. GAF; EverGuard Extreme TPO: www.gaf.com/#sle.
   3. Johns Manville: fleece back www.jm.com/#sle.

B. Insulation:
   1. BASF Corporation; BASF Neopor GPS: www.neopor.basf.us/#sle.
   2. Carlisle SynTec Systems; SecurShield Insulation: www.carlisle-syntec.com/#sle.
   3. DuPont de Nemours, Inc: building.dupont.com/#sle.
   4. GAF: www.gaf.com/#sle.

2.02 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
      a. Thickness: 115 MIL combination tip ply and fleece back - , minimum.
      b. Wind uplift: designed to withstand wind uplift forces calculated with ASCAE7 - minimum according to ICC code with AHJ - authority having jurisdiction.
   2. Sheet Width: 6' wide X 100' long or 12' wide and 50' to 100' long.
      a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.
   3. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane.

D. Through-Wall Flashing with Termination Bar: At least 40 mil, 0.040 inch thick poly-reinforced membrane with extruded termination bar and drip-edge.
   1. Width: 18 inches, minimum.

2.03 INSULATION COVER BOARDS

A. Cover Board: Cement board complying with ASTM C1325.
   1. Board Size: 48 by 96 inches.
   2. Insulation Thermal Resistance: R-value to provide a R-35 minimum over entire roof area within construction area.
   3. Drainage: No standing water within 24 hours after precipitation.

2.04 INSULATION

A. Cellulose Fiber Board Insulation: ASTM C208 Type II; natural finish.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
   2. Board Size: 48 by 96 inches.
   3. Board Thickness: 1.5 inches.
   4. Tapered Board: Slope as indicated; minimum thickness 1/4 inch; fabricate of fewest layers possible.
   5. Board Edges: Square.

2.05 ACCESSORIES

A. Roofing Expansion Joint Flashing: Sheet butyl.

B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.

C. Sheathing Adhesive: Noncombustible type, for adhering gypsum sheathing to metal deck.

D. Sheathing Joint Tape: Paper type, self adhering, as required by Manufacturer.

E. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

F. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

G. Membrane Adhesive: As recommended by membrane manufacturer.

H. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

I. Insulation Adhesive: As recommended by insulation manufacturer.

J. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.

K. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.

L. Insulation Perimeter Restraint: Metal edge device configured to restrain insulation boards in position and provide top flashing over ballast.

M. Sealants: As recommended by membrane manufacturer.

N. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Asphaltic with mineral granule surface or Roofing membrane manufacturer's standard. equal to roofing for foot Traffic.
   2. Surface Color: as selected by architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck:
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
   2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
   3. Tape joints.
   4. Mechanically fasten sheathing to roof deck, in accordance with Factory Mutual recommendations and roofing manufacturer's instructions.
      a. Over entire roof area, fasten sheathing using six fasteners with washers per sheathing board.
      b. At roof perimeter to a distance of 4 ft in from edges, fasten sheathing using six fasteners with washers per board.
   5. Fasten sheathing to roof deck with continuous mopping of adhesive on each flute.

3.03 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings as the work of this section proceeds.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.

2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

H. Do not install more insulation than can be covered with membrane in same day.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate recommended by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Install roofing expansion joints where indicated. Make joints watertight.

H. Coordinate installation of roof drains and sumps and related flashings.

3.06 INSTALLATION - INSULATION OVER MEMBRANE

A. Place insulation boards; butt in close contact. Place channel cut face down. Bevel insulation to allow snug fit at cant strips. Cut neatly around protrusions through roof.

B. Install and fit perimeter restraint to minimize movement of insulation boards.

3.07 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.08 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 075400

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and Pre Finished Metal coping at top of parapet - ref. drawings floor location..

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 042000 - Unit Masonry: Metal flashings embedded in masonry.

B. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.

C. Section 061000 - Rough Carpentry: Wood blocking for batten seams.

D. Section 061000 - Rough Carpentry: Field fabricated roof curbs.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020, with Errata (2022).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

C. ASTM B32 - Standard Specification for Solder Metal 2020.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 ACTION SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. Distinguish between shop- and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.

6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings, as applicable.
7. Details of special conditions
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 3 inches per 12inches.

C. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory..

D. Samples: For each type of exposed finish required, prepare the following samples:
1. Sheet Metal Flashing: 12 inches by actual width 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 in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full size sample.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim Manufacturers:
1. Petersen Aluminum Corporation: www.pac-clad.com/#sle.

B. Exterior Penetration Flashing Panel Manufacturers:
1. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

2.02 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As selected by Architect from manufacturer's standard colors.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches over roofing edge. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).

B. Accessories: Profiled to suit gutters and downspouts.
1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
2. Gutter Supports: Brackets.
3. Downspout Supports: Brackets at 10' o.c. max.

C. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.

D. Downspout Boots: Steel.

E. Downspout Extenders: Same material and finish as downspouts.

F. Seal metal joints.

2.05 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.06 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Galvanized iron type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof. wall or window openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roof and wall termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Secure gutters and downspouts in place with concealed fasteners.

E. Slope gutters 1/4 inch per 10 feet, minimum.

F. Connect downspouts to downspout boots, and grout connection watertight.

G. Set splash pads under downspouts.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof curbs.

B. Roof penetrations mounting curbs.

C. Roof hatches with access ladders.

D. Non-penetrating pedestals.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders current edition.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

D. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
   3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

C. Provide five year manufacturer warranty.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
   2. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation. Reference Mechanical specifications - with a height of 12" minimum
   3. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches. for a curb height of 12" minimum.
   4. Provide layouts and configurations indicated on drawings.

B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
   1. Provide preservative treated wood nailers along top of curb.
   2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
   3. Height Above Roof Deck: 14 inches, minimum.

C. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

2.02 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

A. Provide Roof Access Hatch and ladder as indicated on the drawings where shown on Floor Plan. Coordinate installation with Roof Top Equipment. Reference Architectural and Mechanical Drawings.

B. Roof Hatch Manufacturers:
   1. Acudor Products Inc; Galvanized Steel Roof Hatch: www.acudor.com/#sle.
   2. Babcock-Davis; ThermalMAX: www.babcockdavis.com/#sle.
   3. Best Access Doors; Series BA-GRH - Ladder Access Roof Hatch, Galvanized: www.bestaccessdoors.com/#sle.
   4. Bilco Company; Type TB (various types and special size): www.bilco.com/#sle.
   5. Milcor, Inc www.milcorinc.com/#sle.
   6. Precision Ladders, LLC; Model PH-A: www.precisionladders.com/#sle.

C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Stainless steel, Type 304, 14 gauge, 0.0747 inch thick.

2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
3. Curb Height: 12 inches from surface of roof deck, minimum.

D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gauge, 0.0747 inch thick, liner 22 gauge, 0.03 inch thick.
3. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch thick, liner 0.04 inch thick.
4. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

2.03 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
1. Design Loadings and Configurations: As required by applicable codes.
2. Height: Provide minimum clearance of 9 inches under supported items to top of roofing.
3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.

B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.

C. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
1. Bases: High density polypropylene.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 077200

SECTION 078400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

F. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance ratings, and limitations.

B. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
   2. Hilti, Inc: www.us.hilti.com/#sle.
   3. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
   4. Specified Technologies Inc: www.stifirestop.com/#sle.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

B. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:
   1. Floor-to-Floor Joints:
      a. 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   2. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
      a. 2 Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   3. Head-of-Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
      a. 2 Hour Construction: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.
      b. 2 Hour Construction: UL System HW-D-0312; Specified Technologies Inc. SIL Silicone Sealant.

B. Gypsum Board Walls:

1. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
   a. 2 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
   b. 1 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
2. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
   a. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
3. Head-of-Wall Joints at Concrete Over Metal Deck:
   a. 2 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
   b. 1 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.

2.05 FIRESTOPPING FOR FLOOR-TO-WALL MOVABLE JOINTS

A. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic-D):

2.06 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Blank Openings:
   1. In Floors or Walls:
      a. 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.

B. Penetrations Through Floors or Walls By:
   1. Multiple Penetrations in Large Openings:
      a. 2 Hour Construction: UL System C-AJ-2863; HoldRite HydroFlame 100 Intumescent Firestop Sealant.

C. Penetrations Through Floors By:
   1. Multiple Penetrations in Large Openings:
      a. 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
   2. Electrical Cables Not In Conduit:
      a. 2 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.

D. Penetrations Through Walls By:
   1. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. HVAC Ducts, Insulated:
      a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.07 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
   1. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

B. Penetrations By:
   1. Multiple Penetrations in Large Openings:

a. 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.08 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

3.04 FIELD QUALITY CONTROL

A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 078400

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Sample product warranty.

B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

C. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

D. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

E. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
   3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
      a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1,000 linear feet, and one test per 1,000 linear feet thereafter, or once per floor on each elevation.
      b. If any failures occur in the first 1,000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

C. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Take photographs of each test, with joint identification provided in the photos for example, provide small erasable whiteboard positioned next to joint.
   3. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
   4. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
   5. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

D. Nondestructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

E. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
   1. Sample: At least 18 inches long.
   2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
   3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.

F. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
   1. Bostik Inc: www.bostik-us.com/#sle.
   2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Sika Corporation: www.usa-sika.com/#sle.
   5. Specified Technologies Inc: www.stifirestop.com/#sle.

6. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

B. Self-Leveling Sealants:
1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
2. Sika Corporation: www.usa-sika.com/#sle.
3. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
   a. Joints between door, window, and other frames and adjacent construction.
   b. Joints between different exposed materials.
   c. Openings below ledge angles in masonry.
   d. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
      2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated.
   c. Other joints indicated below.
3. Do not seal the following types of joints:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
7. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors: As selected by Architect.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
2. Non-Staining to Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: Match adjacent finished surfaces.
5. Color: To be selected by Architect from manufacturer's standard range.
6. Products:
   a. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.
   b. Sika Corporation; Sikasil WS-290: www.usa.sika.com/#sle.

B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Products:
   a. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.

C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: as selected by Architect.
2. Products:
   a. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.

D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Color: Match adjacent finished surfaces.
3. Color: To be selected by Architect from manufacturer's standard range.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: Standard colors matching finished surfaces, Type OP (opaque).
2. Color: To be selected by Architect from manufacturer's standard range.

F. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; non-vapor permeable; intended for fully concealed applications.

2.05 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Products:
      a. Sika Corporation; Sikasil 728RCS: www.usa.sika.com/#sle.

B. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
   1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX ARDIFIX: www.ardexamericas.com/#sle.

C. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
   1. Color: as selected by Architect.

D. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
   2. Color: Concrete gray.
   3. Joint Width, Minimum: 1/8 inch.
   4. Joint Width, Maximum: 3/4 inch.
   5. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
   6. Products:
      a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: www.ardexamericas.com/#sle.
      b. SpecChem, LLC; Rapid Flex CJ: www.specchemllc.com/#sle.

2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Open Cell: 40 to 50 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Nondestructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

D. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.

E. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

F. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e., at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 079200

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SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor, wall, ceiling, and corners surfaces.

1.02 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming: Placement of joint cover assembly frames in formwork.

B. Section 042000 - Unit Masonry: Placement of joint cover assembly frames in masonry.

C. Section 079200 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.

D. Section 092116 - Gypsum Board Assemblies: Gypsum board control joint trim.

E. Section 092116 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.

D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

E. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

B. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

C. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner - Joint Cover Assemblies:
   1. Inpro: www.inprocorp.com/#sle.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Interior Floor Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. Balco, Inc; No-Bump Floor to Floor System, Aluminum (NBAF): www.balcousa.com/#sle.

B. Interior Wall/Ceiling Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. Balco, Inc; Wall and Ceiling Snap-On Joint Cover (WD): www.balcousa.com/#sle.
      b. Construction Specialties, Inc; Allway Standard Wall and Ceiling Covers: www.c-sgroup.com/#sle.

C. Interior Fire-Rated Wall/Ceiling/Floor Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. Construction Specialties, Inc; Fire Barriers: www.c-sgroup.com/#sle.

D. Interior/Exterior Fire-Rated Wall Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. EMSEAL Joint Systems, Ltd; Emshield WFR2 System: www.emseal.com/#sle.

E. Exterior Wall Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. Balco, Inc; Exterior Wall, Elastomeric Face Seal System (FCWW): www.balcousa.com/#sle.

2.03 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Joint Cover Styles: As indicated on drawings.
   4. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   5. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

C. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.

1. Exposed Finish at Floors: Mill finish or natural anodized.

B. Resilient Seals:
1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

E. Threaded Fasteners: Aluminum.

2.05 ACCESSORIES

A. Resilient Fire Barrier: For use with metal expansion joint covers and elastomeric seals without use of mechanical fasteners, with fire rating in accordance with surrounding construction performance capabilities.
1. Application: Floor.
2. Fire Resistance Rating: 2-hour, in accordance with ASTM E1966 and UL 2079.
3. Manufacturers:
a. Balco, Inc; Expansion Joint Fire Barrier, Floor/Roof - MetaBlock, 2 Hour (MBF2H): www.balcousa.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

B. Provide strippable coating to protect finish surface.

END OF SECTION 079513

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Commercial security hollow metal doors and frames.

F. Tornado-resistant hollow metal doors and frames.

G. Hollow metal borrowed lites glazing frames.

H. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Glazing: Glass for doors and borrowed lites.

C. Section 099000 - Painting and Coating: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. HMMA: Hollow Metal Manufacturers Association.

C. NFPA: National Fire Protection Association.

D. SDI: Steel Door Institute.

E. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2019.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.

D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2020.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

L. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.

M. FLA (PAD) - Florida Building Code Online - Product Approval Directory Current Edition.

N. ICC 500 - ICC/NSSA Standard for the Design and Construction of Storm Shelters 2020.

O. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

P. Miami (APD) - Approved Products Directory; Miami-Dade County Current Edition.

Q. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames 2012.

R. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

S. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

T. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.

U. NAAMM HMMA 850 - Fire-Rated Hollow Metal Doors and Frames 2014.

V. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames 2018.

W. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

X. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

Y. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

Z. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

AA. UL (DIR) - Online Certifications Directory Current Edition.

BB. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Madera Embossed Woodgrain Doors
3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

B. Tornado-Resistant Hollow Metal Doors and Frames:
1. Megamet Industries, Inc: www.megametusa.com/#sle.
2. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards and TAS Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Hinged edge square, and lock edge beveled.

5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 3 - Stile and Rail.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
   e. Wood grain embossed .005" deep with matching window preparation and matching edges.
   f. Provide clear UV resistant top coat on door, astrigal and window kit.
   g. Provide custom color to match existing stained wood.
2. Door Core Material: Polystyrene, 1 lbs/cu ft minimum density. Polystyrene core
   a. Foam Plastic Insulation: Manufacturer's heavy duty board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thickness: 1-3/4 inches, nominal.
4. Door Face Sheets: Embossed with wood grain.
5. Weatherstripping: Refer to Section 087100.
6. Door Finish: Wood grain and custom stain match with clear UV resistant top coat..

C. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 4 - Maximum-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.
   d. Wood grain embossed .005" deep with matching window preparation and matching edges.
   e. Provide custom color to match existing stained wood.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.
4. Door Face Sheets: Embossed with wood grain.
5. Door Finish: Wood grain and custom stain match with clear UV resistant top coat

D. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 3 - Stile and Rail.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
e. Wood grain embossed .005" deep with matching window preparation and matching
f. Provide thru bolt window kit.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR).
a. Attach fire rating label to each fire rated unit.
4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
5. Door Thickness: 1-3/4 inches, nominal.

E. Tornado-Resistant Doors:
1. Design and size door and frame components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M.
a. Design Wind Loads: Comply with requirements of authorities having jurisdiction.
b. Wind-Borne Debris Resistance: Door and frame components shall have FLA (PAD) approval, Miami (APD) approval, or UL (DIR) approval for Large and Small Missile impact and pressure cycling at design wind loads.
2. Tornado Shelter Application: Equal to ICC 500 standard.
3. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 087100.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Frame Finish: Factory primed and field finished.

E. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
3. Frame Finish: Factory primed and field finished.

F. Tornado-Resistant Door Frames: With same tornado resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
   1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
   2. Frame Finish: Factory primed and field finished.

G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

I. Frames in Masonry or ICF Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

J. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

A. Primer: Grey- Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Door Window Frames: Door window frames with glazing securely thru-bolt fastened within door opening.
   1. Size: As indicated on drawings.
   2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
   3. Metal Finish: grey primer coating.

B. Glazing: As specified in Section 088000.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Install door hardware as specified in Section 087100.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Comply with glazing installation requirements of Section 088000.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

B. Attack-resistant door opening assemblies.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard 2012 (Reaffirmed 2020).

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

E. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.

F. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames 2012.

G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

H. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

I. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata.

1.04 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

D. Manufacturer's qualification statement.

E. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Woodwork Quality Assurance Program:
   1. Provide designated labels on shop drawings as required by quality assurance program.
   2. Provide designated labels on installed products as required by quality assurance program.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers: www.haleybros.com/#sle.
   2. VT Industries, Inc: www.vtindustries.com/#sle.

2.02 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.
   1. Wood Veneer Faced Doors: 7-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Wood veneer facing with factory transparent finish.
   4. Hardboard facing with factory opaque finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Natural birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Running Match" each pair of doors and doors in close proximity to each other.

B. Hardboard Facing for Opaque Finish: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides) hardboard, 1/8 inch thick.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.

C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

G. Provide edge clearances in accordance with the quality standard specified.

2.06 Door Opening Assemblies

A. Provide assemblies meeting referenced general performance requirements.
   1. Fire-Resistance Rating: 20 minutes / 90 minute & as shown on drawings.

B. Opening Sizes:
   1. Single Openings: As indicated on drawings.

C. Door and Sidelite Frames:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

D. Door Types:
   1. Flush wood doors with wood veneer facing.

E. Glazing:
   1. Glass Type: Clear laminated glass, see Section 088000.

2. Size: As indicated on drawings.
3. Door Lite Metal Glazing Frame: Equal to Anemostat # FGS-75 - Thru Bolted
   a. Minimum Glass Bite: 3/8 inch. up to 1" insulated glass
   b. Minimum Steel Gauge: 18 gauge, 0.042 inch.
   c. Through-bolt the lite kit into the door.
   d. Meet Texas Accessibility Standards of 42" max to bottom of frame.

F. Door Hardware: Match project elements with similar functionality and performance requirements, and as follows:
1. Hardware Locks: Manufacturer's standard.
   a. BHMA A156.13 Grade 1 Hardware mortise lock with latchbolt, deadbolt, and escutcheon plate.
2. Balance of door hardware, see Section 087100.

G. Field-Installed Sidelites: Manufacturer's standard construction,
1. Frame Type: As indicated on drawings.
2. Sidelite Size: As indicated on drawings.

2.07 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
1. Transparent:
   a. System - TR-6, Catalyzed Polyurethane.
   b. Stain: As selected by Architect.
   c. Sheen: Semigloss.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.08 ACCESSORIES

A. Hollow Metal Door Frames: See Section 081113.

B. Glazing: See Section 088000.

C. Glazing Stops: Wood with metal clips for rated doors, butted corners; prepared for thru bolted style tamper proof screws.

D. Door Hardware: See Section 087100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

F. Install door louvers plumb and level.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION 081416

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SECTION 083313 - COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated coiling counter doors and operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Rough openings.

B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 092116 - Gypsum Board Assemblies: Rough openings.

D. Section 284600 - Fire Detection and Alarm: Fire alarm interconnection.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.

B. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

C. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coiling Counter Doors:
   1. Overhead Doors, Inc: www.overheaddoor.com/#sle. Style: 657 Integral Frame Counter Door for Food Service
   2. C.H.I. Overhead Doors; Model 6522 (steel): www.chiohd.com/#sle.
   3. Raynor Garage Doors: www.raynor.com/#sle.

2.02 COILING COUNTER DOORS

A. Coiling Counter Doors, Non-Fire-Rated: Stainless steel slat curtain.

1. Mounting: Interior face mounted.
2. Provide integral frame and coordinate with kitchen equipment sill of same material and finish.
3. Nominal Slat Size: 1-1/4 inches wide.
4. Slat Profile: Flat.
5. Finish, Stainless Steel: No. 4 - Brushed.
6. Guides: Formed track; same material and finish unless otherwise indicated.

2.03 MATERIALS

A. Curtain Construction: Interlocking, single thickness slats.
   1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with tube to provide reinforcement and positive contact in closed position.
   3. Stainless Steel Slats: ASTM A666, Type 304; minimum thickness 22 gauge, 0.03 inch.

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
   1. Stainless Steel Guides: ASTM A666, Type 304, rollable temper.

C. Lock Hardware:
   1. Latching Mechanism: Inside mounted, adjustable keeper, spring activated latch bar feature to keep in locked or retracted position.
   2. Latch Handle: Manufacturer's standard.
   3. Push up Manual Lift: Provide keeper on guide & reach bar

D. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

E. High Cycle Springs: 100,000 cycles

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION 083313

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SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

D. Door hardware.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping: Firestop at system junction with structure.

B. Section 085113 - Aluminum Windows: Operable sash within glazing system.

C. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

E. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefronts Manufacturers: Kawneer
1. Kawneer North America: www.kawneer.com/#sle.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Entrance Doors, Wides Stile Widths:

B. Wide Stile, Insulating Glazing, Thermally-Broken:
1. Thickness: 2 inches.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Position: Centered (front to back).
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
3. Finish: Class I natural anodized.
a. Factory finish all surfaces that will be exposed in completed assemblies.
4. Finish Color: As selected by Architect from manufacturer's standard line.

5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.

B. Glazing: See Section 088000.

C. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches.
2. Top Rail: 4 inches wide.
3. Vertical Stiles: 4-1/2 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

2.07 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
1. Finish on Hand-Contacted Items: to match Door hardware Schedule Section 087100.
2. For each door, include butt hinges, pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.

C. Weatherstripping

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

F. Hinges: Butt type, swing clear; top and bottom.

G. Push/Pull Set: Standard configuration push/pull handles.

H. Exit Devices: Panic type.

I. Door Closers: Exposed overhead.

J. Handle Latch:

K. Locks: Dead latch with thumbturn inside; keyed cylinder outside.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 FIELD QUALITY CONTROL

A. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

B. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084313

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SECTION 085113 - ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded Fixed aluminum windows - Coordinate with Storefront Doors

B. Factory glazing.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Steel lintels.

B. Section 061000 - Rough Carpentry: Rough opening framing.

C. Section 072500 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.

D. Section 079200 - Joint Sealants: Sealing joints between window frames and adjacent construction.

E. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products 2021.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

H. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

J. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. PREINSTALLATION Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations and installation requirements.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
1. Evidence of AAMA Certification.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Manufacturer's qualification statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Field verify all existing opening sizes and conditions.

B. Do not install sealants when ambient temperature is less than 40 degrees F.

C. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Kawneer.

2.02 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

B. Fixed, Thermally-Broken: Manufacture as shown below Or Equal
   1. Basis of Design: Kawneer Fixed Windows

2.03 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Frame Depth: 4 inch.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Fixed, Non-Operable Type:
   1. Construction: Thermally broken.
   2. Glazing: Double; Tinted - Architect to select color; low-e. Tipple glazed at teller windows (Reference Glazing - BR glass)
   3. Exterior Finish: Class I natural anodized. - To match Store Front - as selected by architect
   4. Interior Finish: Class I natural anodized.

2.04 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): R.
   2. Performance Grade (PG): Equivalent to or greater than specified design pressure.

B. Design Pressure (DP): In accordance with applicable codes.

C. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

D. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf.

E. Air Leakage: 0.1 cfm/sq ft maximum leakage per unit area of outside window frame dimension when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

F. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.

G. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.

2.05 COMPONENTS

A. Frames: 2" wide by 4" deep profile, ; thermally broken with interior portion of frame insulated from exterior portion; applied glass stops of snap-on type.

B. Glazing: See Section 088000.

C. Sills: extruded aluminum; sloped for positive wash; fit under sash leg to 1/2 inch beyond wall face; one piece full width of opening; jamb angles to terminate sill end.

D. Glazing Materials: See Section 088000.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.07 FINISHES - Match Existing

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mil thick.

B. Finish Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 072500.

3.02 PRE WINDOW INSTALLATION

A. Insure complete existing window has been removed and all caulking and debris has been eliminated before new panning system is installed.

B. Install windows in accordance with manufacturer's instructions.

C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

E. Install sill and sill end angles.

F. Set sill members and sill flashing in continuous bead of sealant.

G. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install glass and infill panels in accordance with requirements; see Section 088000.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

A. Provide services of aluminum window manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Provide field testing of installed aluminum windows b in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf.
2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.

D. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

3.07 Reference Opening Schedule in Architectural Drawings for opening size, types, elevations and details.

END OF SECTION 085113

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SECTION 087100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for fire-rated doors.

B. Electrically operated and controlled hardware.

C. Lock cylinders for doors that hardware is specified on Door Hardware Schedule.

D. Thresholds.

E. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 062000 - Finish Carpentry: Wood door frames.

B. Section 064100 - Architectural Wood Casework: Cabinet hardware.

C. Section 079200 - Joint Sealants: Sealants for setting exterior door thresholds.

D. Section 087101 - Door Hardware Schedule: Schedule of door hardware sets.

E. Section 081113 - Hollow Metal Doors and Frames.

F. Section 081416 - Flush Wood Doors.

G. Section 101400 - Signage: Additional signage requirements.

H. Section 281000 - Access Control: Electronic access control devices.

I. Section 284600 - Fire Detection and Alarm: Electrical connection to activate door closers.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. BHMA A156.1 - Standard for Butts and Hinges 2021.

C. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.

D. BHMA A156.3 - Exit Devices 2020.

E. BHMA A156.4 - Door Controls - Closers 2019.

F. BHMA A156.6 - Standard for Architectural Door Trim 2021.

G. BHMA A156.7 - Template Hinge Dimensions 2016.

H. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.

I. BHMA A156.16 - Auxiliary Hardware 2018.

J. BHMA A156.21 - Thresholds 2019.

K. BHMA A156.22 - Standard for Gasketing 2021.

L. BHMA A156.25 - Electrified Locking Devices 2018.

M. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems 2018.

N. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.

O. DHI (KSN) - Keying Systems and Nomenclature 2019.

P. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

Q. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

S. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

V. UL (DIR) - Online Certifications Directory Current Edition.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

D. Keying Requirements Meeting:
   1. Schedule meeting with the Owner and Architect at the project site to determine Owner keying requirements.
   2. Attendance Required:
      a. CMaR.
      b. Owner.
      c. Architect.
      d. Hardware Installer.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Key control system requirements.

c. Flow of traffic and extent of security required.

5. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
1. List groups and suffixes in proper sequence.
2. Provide complete description for each door listed.
3. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
4. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
2. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Keying Schedule:
1. Submit copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
2. Submit separate detailed scheduled indicating clearly how the owner's final instructions of keying of locks has been fulfilled.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

I. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Lock Cylinders: Five for each master keyed group.
3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.
   1. Require supplier to meet with Owner and Architect to finalize keying requirements and to obtain final instruction in writing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

B. Provide secure lockup for door hardware delivered to the Project but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that the completion of work will not be delayed.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and Texas Accessibility Standards (TAS).
   3. Applicable provisions of NFPA 101.
   4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   5. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   6. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
   1. See Section 281000 for additional access control system requirements.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Door Hardware Schedule.

F. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    a. Aluminum fasteners are not permitted.
    b. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    a. Self-drilling (Tek) type screws are not permitted.
3. Provide wall grip inserts for hollow wall construction.
4. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
5. Fire-Rated Applications: Comply with NFPA 80.
    a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Manufacturers:
1. McKinney and Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Stanley, dormakaba Group, www.stanleyhardwarefordoors.com/#sle.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
    a. Provide hinge width required to clear surrounding trim.
2. Continuous Hinges: Comply with BHMA A156.26.
3. Provide hinges on every swinging door.
4. Provide full mortise butt hinges unless otherwise indicated.
5. Provide ball-bearing hinges at each door with closer.
6. Provide non-removable pins on exterior outswinging doors.
7. Provide following quantity of butt hinges for each door:
    a. Doors wider than 36 inches wide: four hinges.
    b. Doors From 60 inches High up to 90 inches High: Three hinges.
    c. Dutch Doors: Two hinges each leaf.

2.03 FLUSH BOLTS

A. Flush Bolts: Comply with BHMA A156.16, Grade 1.
1. Flush Bolt Throw: 3/4 inch, minimum.
2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
    a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
4. Manual Flush Bolts: Provide lever extensions for top bolt at over-sized doors.

2.04 EXIT DEVICES

A. Manufacturers:
1. Basis of Design:
2. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company :www.assaabloydss.com/#sle.

B. Exit Devices: Comply with BHMA A156.3, Grade 1.

1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.05 LOCK CYLINDERS

A. Manufacturers: - Match Existing County Standard system & Keying Grand Master - Contractor to field verify and provide.
   1. Shall be interchangeable core type. CORBIN RUSSWIN – NO SUBSTITUTE. Restricted, exclusive F2 Keyway.
   2. Establish a new grand master key system to incorporate all district facilities as directed by the Owner.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide cylinders from same manufacturer as locking device.
   2. Provide cams and/or tailpieces as required for locking devices.
   3. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

2.06 CYLINDRICAL LOCKS

A. Manufacturers:
   1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
   1. Bored Hole: 2-1/8 inch diameter.
   2. Latchbolt Throw: 1/2 inch, minimum.
   3. Backset: 2-3/4 inch unless otherwise indicated.
   4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
      a. Finish: To match lock or latch.
   5. Provide a lock for each door, unless otherwise indicated that lock is not required.
   6. Provide an office lockset for swinging door where hardware set is not indicated.
   7. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.07 MORTISE LOCKS

A. Manufacturers:
   1. Basis of Design: No existing Master system is currently in place. A new key system will be established..
   2. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
   1. Latchbolt Throw: 3/4 inch, minimum.
   2. Deadbolt Throw: 1 inch, minimum.
   3. Backset: 2-3/4 inch unless otherwise indicated.

4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
   a. Provide manufacturer's standard wrought box strike for each latch or lock bolt with curved lip extended to protect frame unless otherwise indicated.
      1) Provide recessed top strike for bolts locking into head frames.
      2) Provide dustproof strikes for foot bolts except where special thresh
   b. Finish: To match lock or latch.

2.08 ELECTROMECHANICAL LOCKS

A. Manufacturers:
   1. Basis of Design: No existing system exists. New Card Reader compatible system on applicable openings shall be provided..
   2. Sargent, Yale, or Corbin; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Electromechanical Locks: Comply with BHMA A156.25, Grade 1.
   1. Provide motor-driven or solenoid-driven locks, with strike that is applicable to frame.
   2. Type: Mortise deadbolt.

2.09 AUXILIARY LOCKS (DEADLOCKS)

A. Manufacturers:
   1. Yale or Corbin or Sargent; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Auxiliary Locks (Deadlocks): Comply with BHMA A156.36, Grade 1.
   1. Type: Mortise.
   2. Application: Mortised.
   3. Backset: 2-3/4 inch, unless otherwise indicated.
   4. Bolt Throw: 1 inch, with latch made of hardened steel.
   5. Provide strike that matches frame.

2.10 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Trimco: www.trimcohardware.com/#sle.

B. Door Pulls and Push Unit.
   1. Exposed fasteners: Provide manufacturer standard exposed fastener for installation through bolted for matched pairs but not for single units.
   2. Pull Type: Straight, unless otherwise indicated.
   3. Push Plate Type: Flat, with square corners, unless otherwise indicated.
   4. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
   5. On solid doors, provide matching door pull and push plate on opposite faces.

2.11 DOOR PULLS AND PUSH BARS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Door Pulls and Push Bars: Comply with BHMA A156.6.
   1. Bar Type: Push bar, unless otherwise indicated.
   2. Material: match balance of hardware, unless otherwise indicated.

2.12 COORDINATORS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Trimco: www.trimcohardware.com/#sle.

B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
1. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.13 CLOSERS

A. Manufacturers; Surface Mounted:
1. Corbin Russwin, Norton, Rixson, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. LCN, an Allegion brand: www.allegion.com/us/#sle.

B. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: As indicated in door hardware sets.
2. Provide door closer on each exterior door.
3. Provide door closer on each fire-rated and smoke-rated door.
4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
5. At corridor entry doors, mount closer on room side of door.
6. At outswinging exterior doors, mount closer on interior side of door.

2.14 PROTECTION PLATES - As indicated on Door Hardware Schedule

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Trimco: www.trimcohardware.com/#sle.

B. Metal Properties: Stainless steel.
1. Metal, Heavy Duty: Thickness 0.050 inch, minimum.

C. Fasteners: Countersunk screw fasteners.

2.15 KICK PLATES

A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
1. Size: 10 inch high by 1 inch less door width (LDW) on push side of door.

2.16 DOOR HOLDERS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company; [_____]: www.assaabloydss.com/#sle.
2. Trimco: www.trimcohardware.com/#sle.

B. Door Holders: Comply with BHMA A156.16, Grade 1.
1. Type: Positive mechanical, spring loaded roller.
2. Material: Chrome plated brass or bronze.

2.17 FLOOR STOPS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Trimco: www.trimcohardware.com/#sle.

B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
2. Material: Stainless Steel or Chrome plated brass/bronze housing with rubber insert.

2.18 WALL STOPS

A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide wall stops to prevent damage to wall surface upon opening door.
2. Type: Bumper, concave, wall stop.
3. Material: Stainless Steel or Chrome plated brass/bronze housing with rubber insert.

2.19 ASTRAGALS

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Zero International, Inc: www.zerointernational.com/#sle.

B. Astragals: Comply with BHMA A156.22.
1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
2. Type: Split, two parts, and with sealing gasket.
3. Material: Aluminum, with neoprene weatherstripping.
4. Provide non-corroding fasteners at exterior locations.

2.20 THRESHOLDS

Except as otherwise indicated, provide metal threshold unit of type, size, and profile as shown or scheduled.

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Zero International, Inc: www.zerointernational.com/#sle.

B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at interior doors for transition between two different floor types, and over building expansion joints, unless otherwise indicated.
2. Type: Interlocking. with bumper seal - 1/2" high maximum
3. Material: Aluminum.
4. Threshold Surface: Fluted horizontal grooves across full width.
5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.
7. At exterior hinge or pivoted doors, provide units not less than 4" wide formed to accommodate change in floor elevation where indicated; fabricated to accommodate door hardware and fit door frames as follows:

a. For inswinging doors, provide units with interlocking lip and interior drain channel, include hook on bottom edge of door and drain pan.
b. For outswinging doors, provide units with interlocking lip and with hook on bottom edge of door to act as weather bar.
c. For outswinging doors provide rabbeted type units with weatherstrip in stop.

2.21 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
1. Zero International, Inc: www.zerointernational.com/#sle.

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
1. Head and Jamb Type: Adjustable.
2. Door Sweep Type: Encased in retainer.
3. Material: Aluminum, with brush weatherstripping.
4. Provide gasketing for rated door that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
5. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
6. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.22 SILENCERS

A. Manufacturers:
1. Ives, an Allegion brand: www.allegion.com/us/#sle.
2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
1. Single Door: Provide three on strike jamb of frame.
2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
3. Material: Rubber, gray color.

2.23 ELECTRONIC ACCESS MANAGEMENT SYSTEMS

A. Electronic Access Management Systems: Comply with guidelines of BHMA A156.25, and including necessary hardware for fully functional system.
1. Reader Formats: Provide "Smart Card" iclass format with card reader to activate access system functionality.
2. Provide system controller, door controllers, system software, enclosures, power supplies, cabling, credentials, configuration, training, and commissioning, as required and scheduled herein.
3. Door Locking Hardware: Provide applicable cylindrical locksets, panic hardware, or mortise locksets in compliance with project access control requirements.

2.24 KEY CONTROL SYSTEMS

A. Manufacturers:
1. Sargent or Corbin Russwin; an Assa Abloy Group company: www.assaabloydss.com/#sle.

B. Key Control Systems: Comply with guidelines of BHMA A156.28.
1. Provide keying information in compliance with DHI (KSN) standards.
2. Keying: Grand master keyed.
3. Include construction keying and control keying with removable core cylinders.

4. Key to a new keying system as directed by Owner.
5. Supply keys in following quantities:
   a. 4 each Master keys.
   b. 1 each Grand Master keys.
   c. 1 each Great Grand Master keys.
   d. 6 each Construction Master keys.
   e. Construction keys.
   f. Construction Control keys.
   g. 2 each Keys for each keyed core.
6. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
7. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."

2.25 KEY CABINET

A. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
   1. Mounting: Wall-mounted.
   2. Capacity: Actual quantity of keys, plus 50 percent additional capacity.
   3. Size key hooks to hold 6 keys each.
   4. Finish: Baked enamel, manufacturer's standard color.
   5. Key cabinet lock to building keying system.

2.26 POWER SUPPLY

A. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
   1. Power: 24 VAC, 10 Amp; with 120 VAC power supply.
   2. Operating Temperature: 32 to 110 degrees F.
   3. Provide with emergency release terminals that release devices upon activation of fire alarm system.

2.27 FINISHES

A. Finishes: Identified in Door Hardware Schedule. - all to match similar in color & existing hardware color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Install hardware for smoke and draft control doors in accordance with NFPA 105.

D. Use templates provided by hardware item manufacturer.

E. Do not install surface mounted items until application of finishes to substrate are fully completed.

F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item as indicated or required by governing regulations including but not limited to applicable building codes and Texas Accessibility Standards.
   1. For Steel Doors and Frames: See Section 081113.
   2. Flush Wood Doors: See Section 081416.
   3. Mounting heights in compliance with ADA Standards and Texas Accessibility Standards:

G. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 07 Joint Sealants.

3.03 ADJUSTING

A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

D. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the installer, accompanied by representatives of the manufacturer's latchsets and locksets and of door control devices and of other major hardware suppliers, shall return to the Project to perform the following work:
   1. Examine and re-adjust each item of door hardware, as necessary, to restore function of doors and hardware to comply with specified requirements.
   2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
   3. Replace hardware items that have deteriorated or failed due to faulty materials or installation.
   4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION 087100

SECTION 087101 – DOOR HARDWARE SCHEDULE

SET

Doors: 101A

2	Continuous Hinge	CFM 83 HD1 SER12		PE
1	Exit Device	ED5200S M54 M92 MELR	630	CR
1	Exit Device	ED5200S x K157 X CT6 M54 M92 MELR	626, 630	CR
1	Core	CR8000 KEYWAY - F2	626	CR
2	Offset Door Pull	BF158	US32D	RO
2	Closer	DC8210 A11 M54 M77 W33	689	CR
2	ElectroLynx Harness	QC-C1500		MC
2	ElectroLynx Harness	QC-C012		MC
2	Door Position Switch	DPS-W-BK		SN
1	Credential Reader	ET10-7WS	BLK	RS2T
2	Aiphone Video Intercom System	JOS-1VW		AIPH

NOTE: Weatherstripping and thresholds, by door supplier.
Location of Aiphone intercoms, to be determined during construction.

SET

Doors: 102A

2	Continuous Hinge	CFM 83 HD1 SER12		PE
1	Exit Device	ED5200S M54 M92 MELR	630	CR
1	Exit Device	ED5200S x K157 X CT6 M54 M92 MELR	626, 630	CR
1	Core	CR8000 KEYWAY - F2	626	CR
2	Offset Door Pull	BF158	US32D	RO
2	Closer	DC8210 A11 M54 M77 W33	689	CR
2	ElectroLynx Harness	QC-C1500		MC
2	ElectroLynx Harness	QC-C012		MC
2	Door Position Switch	DPS-W-BK		SN
1	Momentary Push Button	TS-18		MIHW
		NOTE: Mounted at Reception desk, to release door.		
1	Credential Reader	ET10-7WS	BLK	RS2T

NOTE: Weatherstripping and thresholds, by door supplier.
Push button switch to be located at reception desk, to release door 102A for access to school corridor.

SET

Doors: 122A, 151A, 156A, 161A

1	Continuous Hinge	CFM 83 HD1		PE
1	Continuous Hinge	CFM 83 HD1 SER12		PE
1	Lockable Mullion	907BKM CT6R		CR
1	Exit Device	ED5200S x K157 X CT6 M54 M92 MELR	626, 630	CR
1	Exit Device	ED5200S M51 M54	630	CR
2	Core	CR8000 KEYWAY - F2	626	CR
1	Offset Door Pull	BF158	US32D	RO
2	Closer	DC8210 A11 M54 W33	689	CR
2	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	ElectroLynx Harness	QC-C1500		MC
1	ElectroLynx Harness	QC-C012		MC
2	Door Position Switch	DPS-W-BK		SN
1	Weatherstrip	303 AS 1 x 72" 2 x 84" TKSP8		PE
2	Door Bottom	315 CN 36" TKSP8		PE
1	Threshold	171 A 72" Tapcon Screws		PE
1	Credential Reader	ET10-7WS	BLK	RS2T

SET

Doors: 165A

2	Continuous Hinge	CFM 83 HD1 SER12		PE
1	Exit Device	ED5200S M54 M92 MELR	630	CR
1	Exit Device	ED5200S x K157 X CT6 M54 M92 MELR	626, 630	CR
1	Core	CR8000 KEYWAY - F2	626	CR
2	Offset Door Pull	BF158	US32D	RO
2	Closer	DC8210 A11 M54 M77 W33	689	CR
2	ElectroLynx Harness	QC-C1500		MC
2	ElectroLynx Harness	QC-C012		MC
2	Door Position Switch	DPS-W-BK		SN
1	Credential Reader	ET10-7WS	BLK	RS2T

NOTE: Weatherstripping and thresholds, by door supplier.

SET

Doors: 192A

1	Continuous Hinge	CFM 83 HD1 SER12		PE
1	Electrified Lockset	ML20606 X NAC NSM CT6R SEC	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC8210 A12 M54 W42	689	CR
1	Protection Plate	K1050 36" x 46" CSK	US32D	RO
1	ElectroLynx Harness	QC-C1500		MC
1	ElectroLynx Harness	QC-C400		MC
1	Credential Reader	ET10-7WS	BLK	RS2T
1	Raindrip	346 C 54" TKSP8		PE
1	Weatherstrip	303 AS 1 x 48" 2 x 84" TKSP8		PE
1	Door Bottom	315 CN 48" TKSP8		PE
1	Threshold	171 A 48" Tapcon Screws		PE

SET

Doors: 133B, 190B

1	Continuous Hinge	CFM 83 HD1		PE
1	Exit Device	ED5200S M51 M54	630	CR
1	Closer	DC8210 A11 M54 W33	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Door Position Switch	DPS-W-BK		SN
1	Raindrip	346 C 40" TKSP8		PE
1	Weatherstrip	303 AS 1 x 36" 2 x 84" TKSP8		PE
1	Door Bottom	315 CN 36" TKSP8		PE
1	Threshold	171 A 36" Tapcon Screws		PE

SET

Doors: 135B, 200B

1	Continuous Hinge	CFM 83 HD1		PE
1	Lockset	ML2067 NSA CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Overhead Holder	9-326	652	RX
1	Raindrip	346 C 54" TKSP8		PE
1	Weatherstrip	303 AS 1 x 48" 2 x 84" TKSP8		PE
1	Door Bottom	315 CN 48" TKSP8		PE
1	Threshold	181 AV 48" Tapcon Screws		PE

SET

Doors: 165B

2	Continuous Hinge	CFM 83 HD1		PE
2	Dummy Bar	ED5000DB	630	CR
2	Offset Door Pull	BF158	US32D	RO
2	Closer	DC8210 A11 M54 M77 W33	689	CR

NOTE: Weatherstripping and thresholds, by door supplier.

SET

Doors: 122B, 156B, 161B

2	Continuous Hinge	CFM 83 HD1		PE
2	Dummy Bar	ED5000DB	630	CR
2	Offset Door Pull	BF158	US32D	RO
2	Closer	DC8210 M54	689	CR
2	Protection Plate	K1050 10" x 34" CSK	US32D	RO
2	Dome Stop	441H	US26D	RO
2	Weatherstrip	303 AS 1 x 72" 2 x 84" TKSP8		PE
2	Door Silencer	608-RKW	GREY	RO

SET

Doors: 103A

2	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Electric Hinge	TA2714 4 1/2 X 4 1/2 CC8	26D	MC
1	Electrified Lockset	ML20606 X NAC NSM CT6R SEC	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC6210 A4 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	ElectroLynx Harness	QC-C1500		MC
1	Momentary Push Button	TS-18		MIHW
		NOTE: Mounted at Reception desk, to release door.		
1	ElectroLynx Harness	QC-C300		MC
3	Door Silencer	608-RKW	GREY	RO
1	Reader	ET20-7WS	BLK	RS2T

SET

Doors: 188A, 151C

6	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockable Mullion	907BKM CT6R		CR
1	Exit Device	ED5200 M52 M54	630	CR
1	Exit Device	ED5200 x K157 X CT6 M52 M54	626, 630	CR
4	Core	CR8000 KEYWAY - F2	626	CR
2	Mortise Cylinder	CR1080-114-A02-6 CT6R	626	CR
2	Offset Door Pull	BF158	US32D	RO
2	Closer	DC6210 M54	689	CR
2	Protection Plate	K1050 10" x 34" CSK	US32D	RO
2	Automatic Door Holder w/ Stop	491-RKW	US26D	RO
2	Door Silencer	608-RKW	GREY	RO

SET

Doors: 103C, 124A, 141A, 176A, 176B

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3351 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC6210 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 104A, 113B, 116B, 118A, 119B, 153A, 179A-1, 180A-1, 198A, AG101A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3351 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 110A, 111A, 112A, 115A, 131A, 132A, 152A, 179A, 180A, 193A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3351 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Overhead Stop	10-336	652	RX
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 117B, 119A, 125A, 126A, 127A, 128A, 137A, 138A, 139A, 140A, 174A, 175A, 175D, 177A, 178A, 181A, 183A, 183B, 184A, 187A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3352 NZD CT6R	626	CR
2	Core	CR8000 KEYWAY - F2	626	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 133A, 182A, 184D, 185A, 185B, 186A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3352 NZD CT6R	626	CR
2	Core	CR8000 KEYWAY - F2	626	CR
1	Overhead Stop	9-336	652	RX
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 129A, 134B, 136A

4	Hinges	SP3786 4 1/2 x 4 1/2	26D	MC
1	Multi-Point Lock	FE6673 NSA CT6R	626	CR
2	Core	CR8000 KEYWAY - F2	626	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 129B, 134A, 136B

4	Hinges	SP3786 4 1/2 x 4 1/2	26D	MC
1	Multi-Point Lock	FE6673 NSA CT6R	626	CR
2	Core	CR8000 KEYWAY - F2	626	CR
1	Overhead Stop	9-336	652	RX
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 130A

4	Hinges	SP3786 4 1/2 x 4 1/2	26D	MC
1	Multi-Point Lock	FE6618 NSA CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 109A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3351 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC6210 M54	689	CR
1	Overhead Stop	9-336	652	RX
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 190A, 190C

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3355 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC6210 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 195A, 195B

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3351 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC6210 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Automatic Door Holder w/ Stop	491-RKW	US26D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 189A

6	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Extension Flush Bolt	555	US26D	RO
1	Deadlock	DL4113 CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
2	Pull Plate	110 X 70C	US32D	RO
2	Push Plate	70E 6 X 16	US32D	RO
2	Closer	DC6210 M54	689	CR
2	Overhead Holder	9-326	652	RX
2	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Dust Proof Strike	570	US26D	RO
2	Door Silencer	608-RKW	GREY	RO

SET

Doors: 114A

3	Hinges	TA2714 4 1/2 X 4 1/2 NRP	26D	MC
1	Lockset	ML2067 NSA CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Overhead Stop	10-336	652	RX
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 107A, 108A, 169A, 173A, 197A, AG104A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Privacy Set	CLX3320 NZD	626	CR
1	Closer	DC6210 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 167A, 168A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Pull Plate	110 X 70C	US32D	RO
1	Push Plate	70F 8 X 16	US32D	RO
1	Closer	DC6210 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Dome Stop	441H	US26D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 179B

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3362 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 135A, 200A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3357 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Wall Stop	409	US32D	RO
1	Smoke Seal	S88 D 17'		PE
1	Door Bottom	315 CN 36" TKSP8		PE
1	Threshold	171 A 36" Tapcon Screws		PE
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 196A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3357 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Overhead Stop	10-336	652	RX
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 153B

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Privacy Set	CLX3320 NZD	626	CR
1	Overhead Stop	9-336	652	RX
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: 194A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3357 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Wall Stop	409	US32D	RO
3	Door Silencer	608-RKW	GREY	RO

SET

Doors: AG100A

1	Continuous Hinge	CFM 83 HD1		PE
1	Lockset	CLX3355 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC8210 M54	689	CR
1	Overhead Stop	9-336	630	RX
1	Weatherstrip	303 AS 1 x 36" 2 x 84" TKSP8		PE
1	Door Bottom	315 CN 36" TKSP8		PE
1	Threshold	171 A 36" Tapcon Screws		PE

SET

Doors: AG102A, AG105A

3	Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1	Lockset	CLX3352 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR
1	Closer	DC6210 A4 M54	689	CR
1	Protection Plate	K1050 10" x 34" CSK	US32D	RO
1	Weatherstrip	303 AS 1 x 36" 2 x 84" TKSP8		PE
1	Door Bottom	315 CN 36" TKSP8		PE
1	Threshold	171 A 36" Tapcon Screws		PE

SET

Doors: AG103A, AG105B

1	Lockset	CLX3351 NZD CT6R	626	CR
1	Core	CR8000 KEYWAY - F2	626	CR

NOTE: Existing door to remain. Re-use balance of existing hardware. Verify backset and strike.

SET

Doors: AG105D

1	Lockset	CLX3352 NZD CT6R	626	CR
2	Core	CR8000 KEYWAY - F2	626	CR

NOTE: Existing door to remain. Re-use balance of existing hardware. Verify backset and strike.

SET

Doors: SYSTEM REQUIREMENTS

1	Access It Universal	SL1-SOFT	MIHW
1	Single Client License	ACCESS IT S-CLIENT	RS2T
1	Panel Enclosure	NCL-12	RS2T
1	Network control panel 2-door	LP-1502	MIHW
6	Auxiliary control panel 2-door	MR-52-S3	MIHW
2	Power Supply	AQS2410-16C16R2	SN
100	Card Credential	50H4	MIHW
1	Certified System Setup	INSTALLATION & CONFIGURATION OF SYSTEM CONTROLLERS	MIHW
1	Factory Certified	HARDWARE INSTALLATION, WIRING, AND CONNECTIONS	MIHW
1	Home Run Installation	PULL & CONNECT HOME RUNS CABLES	MIHW
1	Aiphone Cable	87180250C	MIHW

SECTION 088000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 062000 - Finish Carpentry: Components with requirement for plastic.

B. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.

C. Section 081113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

D. Section 081416 - Flush Wood Doors: Glazed lites in doors.

E. Section 085113 - Aluminum Windows: Glazing provided by window manufacturer.

F. Section 088300 - Mirrors.

G. Section 102800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

G. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.

H. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.

I. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data on For each product and glazing material indicated.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design and extent to that indicated for the project and whose work has resulted in construction with a record of successful in service performance.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

D. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide Manufacturer Equal to:
   1. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Fully Tempered Type: Complies with ASTM C1048. 3/8" thick in butt glazed corridor windows; 1/4" thick in vision panels.

2.04 INSULATING GLASS UNITS

A. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulated Glass Units: Double Glazed.
   1. Applications: Exterior glazing unless otherwise indicated - Double Glazed.
   2. Space between lites filled with air.
   3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum - tinted as selected by architect from manufacturers standard colors (grey, bronze)
      a. Coating: Self-cleaning type, on #1 surface.
      b. Coating: Low-E (passive type), on #2 surface.
   4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   5. Total Thickness: 1 inch.
   6. Thermal Transmittance (U-Value), Summer - Center of Glass: .57, nominal.
   7. Visible Light Transmittance (VLT): 39% percent, nominal.
   8. Winter Day time U-Value: 0.48
   9. Solar Heat Gain Coefficient (SHGC): .45, nominal.
   10. Glazing Method: Dry glazing method, gasket glazing.

C. Insulating Glass Units: Safety glazing.

1. Applications:
   a. Other locations required by applicable federal, state, and local codes and regulations.
2. Space between lites filled with air.
3. Glass Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.
4. Total Thickness: 1 inch.
5. Thermal Transmittance (U-Value), Summer - Center of Glass:

2.05 GLAZING UNITS

A. Interior Vision Panel Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal,

2.06 GLAZING COMPOUNDS

A. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.

B. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

D. Manufacturers: Equal to but not limited to:
   1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.Dow Corning Corporation: www.dowcorning.com/construction/#sle.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

2.08 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide shop inspection and testing.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.08 SCHEDULES - Reference Architectural Drawings for Schedule, Types, Elevations & Details.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.
   1. Annealed float glass.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.05 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mirrors:
   1. Walker Glass Company Ltd; Walker Glass Mirrors: www.walkerglass.com/#sle.

2.02 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with silver coatings, and protective overcoating.
   1. Thickness: 1/4 inch.
   2. Edges: Arrised.
   3. Size: As indicated on drawings.

2.03 ACCESSORIES

A. Glazing Clips: Manufacturer's standard type.

B. Mirror Attachment Accessories: Stainless steel clips.

C. J-Shape Frame: Aluminum extrusion, dimensions as detailed on drawings.
   1. Material: Comply with ASTM B221 (ASTM B221M), 6005-T6 alloy and temper.
   2. Finish: Anodized, clear.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors with clips, and anchor rigidly to wall construction.

3.03 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION 088300

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Cementitious backing board.

G. Gypsum Wallboard & Abuse Resistant Wallboard

H. Joint treatment and accessories.

I. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 072100 - Thermal Insulation: Acoustic insulation.

D. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

F. Section 092216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2018).

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

H. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).

I. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.

M. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

N. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

O. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.

P. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2021.

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

R. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

S. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

T. ASTM E413 - Classification for Rating Sound Insulation 2022.

U. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

V. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

W. GA-226 - Application of Gypsum Board to Form Curved Surfaces 2019.

X. GA-600 - Fire Resistance Design Manual Sound Control 2021.

Y. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, joint finishing system, and cement backer board.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies.
1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
1. Fire-Resistance-Rated Partitions: UL listed assembly No. 419; 1 hour rating.
2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Substitutions: See Section 016000 - Product Requirements.

B. Non-structural Steel Framing for Application of Gypsum Board

C. Structural Steel Framing for Application of Gypsum Board: See Section 054000.

D. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
1. Studs: C-shaped with flat faces.
a. Products:
1) ClarkDietrich: www.clarkdietrich.com/#sle.
2) MBA Building Supplies; ProSTUD: www.mbastuds.com/#sle.
3) Substitutions: See Section 016000 - Product Requirements.
2. Depth / Size: 2 2/1 inch, 3 5/8 inch, 4 inch, or 6 inch - refer to the drawings for depth / size.
3. Gauge / Thickness: 25 gauge (.0179 inch) unless otherwise noted on the drawings (20 gauge - .0312 inch used at some locations). Studs shall have flange edge of studs bent back 90 degrees and doubled over to form 3/16 inch-wide minimum lip (return) and have the minimum thickness of base metal (uncoated) as indicated.
4. Runners: U shaped, sized to match studs.

5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch. used on walls and suspended gypsum board ceilings.
    a. Products:
        1) Clark/Dietrich: www.clarkdietrich.com.
        2) Substitutions: See Section 016000 - Product Requirements.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with metal stud framing / kickers extend in each direction..

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
    a. Products:
        1) ClarkDietrich; BlazeFrame RipTrak: www.clarkdietrich.com/#sle.

G. Non-structural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
    a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
    b. Height: as shown on drawings
3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

H. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
1. Products:
    a. USG Corporation; Drywall Suspension System: www.usg.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
4. National Gypsum Company: www.nationalgypsum.com/#sle.
5. USG Corporation: www.usg.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
3. Thickness:

a. Vertical Surfaces: 5/8 inch.
b. Ceilings: 5/8 inch.
c. At curved, or shaped areas, provide: 1/4 inch. Equal to USG Sheetrock Brand Flexible Gypsum Panels.
d. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

4. Paper-Faced Products:
   a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
   b. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
   c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
   d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
   e. USG Corporation; USG Sheetrock Brand Firecode X Panels: www.usg.com/#sle.

C. Abuse Resistant Wallboard:
1. Application: In classrooms up to 9' high.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
4. Type: Fire-resistance-rated Type X, UL or WH listed.
5. Thickness: 5/8 inch.
6. Edges: Tapered.
7. Paper-Faced Products:
   a. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech: www.certainteed.com/#sle.
   b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant: www.gpgypsum.com/#sle.
   c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Abuse Gypsum Board: www.goldbondbuilding.com/#sle.

D. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated- Corridors up to 9'
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Fire-resistance-rated Type X, UL or WH listed.
4. Thickness: 5/8 inch.
5. Edges: Tapered.
6. Paper-Faced Products:
   a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com/#sle.
   b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.

E. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind all porcelain wall tile
2. Application: Horizontal surfaces behind tile in wet areas including countertops.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   a. Thickness: 1/2 inch.

F. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Core Type: Regular.
5. Regular Board Thickness: 1/2 inch.
6. Edges: Square.

7. Glass Mat Faced Products:
   a. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
   b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com/#sle.

2.04 GYPSUM BOARD ACCESSORIES

A. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
      a. Products:
         1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
         2) ClarkDietrich; Strait-Flex Big-Stick: www.clarkdietrich.com/#sle.
   2. Corner Beads: Low profile, for archways.
      a. Products:
         1) ClarkDietrich; Strait-Flex Arch-Stick: www.clarkdietrich.com/#sle.
   3. Expansion Joints: - Located above each side of each door or window in drywall walls.
      a. Type: V-shaped PVC with tear away fins.
      b. Type: V-shaped metal with factory-installed protective tape.
      c. Products:
         1) ClarkDietrich: www.clarkdietrich.com.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Joint Compound: Setting type, field-mixed.

C. Finishing Compound: Surface coat and primer, takes the place of skim coating.

D. Textured Finish Materials: Latex-based compound; plain.
   1. Products:
      a. CertainTeed Corporation; Extreme Texture Coat/Acrylic Texture with M2Tech: www.certainteed.com/#sle.
      b. Sherwin-Williams; Tuff Surface Premium Texture Finish: www.sherwin-williams.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

F. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

G. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.
3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
1. Extend partition framing where indicated, to roof or floor structure..
2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with bridging metal stud framings as indicated.
3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
1. Orientation: Horizontal.

F. Blocking: Install wood blocking for support of:
1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.
7. Other locations as directed by the CM@R

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board parallel to framing, with ends and edges occurring over firm bearing - stud.
1. Exception: Tapered edges to receive joint treatment at right angles to framing.
2. Do not use a horizontal joint at or adjacent to head of door and window frames
3. At doors and windows use full vertical piece with expansion joint at each corner.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

F. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.
   2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

G. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.

H. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

I. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

J. Curved - Arched Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long and at the head of each interior door and on the inside side of windows.
   2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.05 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 3: Walls to receive textured wall finish.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at base layer of double-layer applications.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 092116

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 052100 - Steel Joists: Execution requirements for anchors for attaching work of this section.

B. Section 054000 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.

C. Section 061000 - Rough Carpentry: Wood blocking within stud framing.

D. Section 092116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories Equal to:

1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Simpson Strong Tie: www.strongtie.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as indicated on drawings.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
1. Studs: C shaped with ribbed webs, and flanges with rolled edge stiffeners. No dimpled studs will be accepted.
2. Runners: U shaped, sized to match studs.
3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
4. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

D. Non-Loadbearing Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
4. Sheet Metal Backing: 0.036 inch thick, galvanized.
5. Fasteners: ASTM C1002 self-piercing tapping screws.
6. Anchorage Devices: Powder actuated.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs as indicated.

D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

E. Align and secure top and bottom runners at 24 inches on center.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Install studs vertically at 16 inches on center.

H. Align stud web openings horizontally.

I. Secure studs to tracks using fastener method. Do not weld.

J. Stud splicing is permissible; splice studs with 8 inch nested lap, secure each stud flange with flush head screw.

K. Fabricate corners using a minimum of three studs.

L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

M. Brace stud framing system rigid.

N. Coordinate erection of studs with requirements of door frames; install supports and attachments.

O. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

P. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

Q. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.03 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

I. Laterally brace suspension system.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 092216

SECTION 093000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic accessories.

D. Ceramic trim.

E. Non-ceramic trim.

F. Reference Alternates for Tile Wainscot in corridors and Alternate for reduction of tile in toilet rooms.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 092116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.

B. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).

C. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).

D. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

E. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

F. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).

G. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar 2019.

H. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2021.

I. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2019.

J. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.

K. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).

L. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2021.

M. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.

N. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

O. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

P. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Tile: 3 percent of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE - Reference Alternates for Tile in corridors and toilet rooms.

A. Manufacturers: All products of each type by the same manufacturer.
1. American Olean Corporation: www.americanolean.com/#sle.
2. Crossville Studios, Inc: www.crossvillestudios.com
3. Dal-Tile Corporation: www.daltile.com/#sle.
4. Interceramic https://interceramicusa.com/.
5. Substitutions: See Section 016000 - Product Requirements.

B. Ceramic Mosaic Tile Wall (Accent): ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: 5/8" x 5/8", nominal.
3. Shape: Multiple size rectangles.
4. Edges: Square.
5. Surface Finish: Unglazed.
6. Color(s): To be selected by Architect from manufacturer's standard range.

C. Glazed Wall Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
2. Product: Accent tile from Dal Tile subway Color Wheel Classic series 3 X 6 and Field Tile or 6 X 6 inch nominal field tile.
3. Product: Crossville Studio : Middle Ground 6 X 6 or 12 X 12 or 12 X 24 or Crossville Studio: Argent 6 X 6 or 6 X 24 or 12 X 24 accent tile.
4. Edges: Cushioned.
5. Surface Finish: Matte glaze.
6. Color(s): To be selected by Architect from manufacturer's standard range to match existing equal to Dal Tile Coordinating Accent tiles to the Color Wheel series.
7. Pattern: may include multiple colors from colors provided - Architect will provide pattern with color schedule after colors are selected..
8. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile. Schluter - Rondec aluminum trim may be used in lieu of bullnose tiles at horizontal or vertical tile edges.

D. Quarry Tile, Type Floor: ANSI A137.1 standard grade.
1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
2. Size: 12 X 12 or 8 X 8, nominal.
3. Thickness: 1/2 inch, nominal.
4. Edges: Square.
5. Surface Finish: Unglazed.
6. Color(s): To be selected by Architect from manufacturer's standard range.
7. Trim Units: Matching shapes in sizes coordinated with field tile.
8. Products:
a. Dal-Tile Corporation; Quarry Tile: www.daltile.com/#sle.
b. Crossville Studios: Owen Stone Porcelain Stone 24 X 24 or 12 X 24
c. Crossville Studios: Basalt Porcelain Stone 12 X 12 or 12 X 24

E. Tile - Floor: ANSI A137.1 standard grade. Provide one of the following:
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: 12 by 12 inch Standard Floor Porcelain tile. - Continental Slate Color Body Porcelain Floor tile and accents pattern or boarder
3. Thickness: 5/16 inch.
4. Edges: Interlocking shape.
5. Surface Finish: Matte glazed.
6. Color and patterns to be selected from full range of colors in series by architect.
7. Trim Units: Matching shapes in sizes coordinated with field tile.
8. Products: One of the following:
   a. Dal-Tile Corporation; Color Body Continental Slate 12 x 12 inch: www.daltile.com/#sle.
   b. Dal-Tile Corporation Continental Slate accent 4 X 12, 6 X 6 or 3 X 3
   c. Crossville Studios, Inc.; Argent Porcelains Stone- 12 X 24 or assorted sizes for accent colors: www.crossvillestudios.com
   d. Crossville Studios, Inc: Absolute Porcelain Stone - 12 X 24 : www.crossvillestudios.com
   e.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Ceramic Trim: Matching bullnose and cove base ceramic shapes in sizes coordinated with field tile.

C. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
   a. Open edges of wall tile.
   b. Wall corners, outside and inside.
   c. Transition between floor finishes of different heights.
   d. Borders and other trim as selected by architect.
2. Manufacturers:
   a. Schluter-Systems: www.schluter.com/#sle.

D. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
1. Thickness: 1/2 inch.
2. Material: Marble, honed finish.
3. Color and Pattern: As selected by the Architect.
4. Applications:
   a. At doorways where tile terminates.
   b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:
1. Custom Building Products: www.custombuildingproducts.com/#sle.
2. LATICRETE International, Inc: www.laticrete.com/#sle.

C. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.

1. Applications: Where indicated on drawings.
2. Products:
   a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: www.custombuildingproducts.com/#sle.
   b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.

D. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
1. Applications: Floors and Walls.
2. Products:
   a. Custom Building Products: www. custombuildingproducts.com.
   b. LATICRETE International, Inc.: www.laticrete.com.
   c. Substitutions: See Section 016000 - Product Requirements.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:
1. Custom Building Products: www.custombuildingproducts.com/#sle.
2. LATICRETE International, Inc: www.laticrete.com/#sle.

C. Standard Grout: ANSI A118.6 standard cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As selected by Architect from manufacturer's full line.
4. Products:
   a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.
   b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.

2.05 Maintenance Materials

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
   a. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
   b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.

C. Tile Sealer: Stain protection for glazed tile, porcelain tile, and quarry tile.
1. Products:
   a. Custom Building Products; Aqua Mix Enrich 'N' Seal: www.custombuildingproducts.com/#sle.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 20 mils, maximum.
      c. Products:
         1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
         2) Substitutions: See Section 016000 - Product Requirements.

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

C. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated.

M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.05 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

D. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

3.08 SCHEDULE

A. Refer to the "Finish Schedule" in Section 099990 for locations of porcelain floor and wall tile.

END OF SECTION 093000

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

D. Decorative Cloud ceiling shapes - rectangles

E. Decorative Cloud ceiling shapes - Ellipse

1.02 RELATED REQUIREMENTS

A. Section 072100 - Thermal Insulation: Acoustical insulation.

B. Section 233713 - Diffusers, Registers, and Grilles: Air diffusion devices in ceiling.

C. Section 283111 - Digital, Addressable Fire Alarm System with Voice Evacuation: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6" by 6" inch in size of each specified ceiling tile illustrating material and finish of acoustical units to provide color match and approval .

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Texas.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, until all 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 the Project when occupied for its intended use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
   3. USG Corporation:www.usg.com/ceilings/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
   3. USG Corporation: www.usg.com/ceilings/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels Painted mineral fiber, with the following characteristics: Standard use - Reference Finish Schedule
   1. Classification: ASTM E1264 Type IX.
      a. Fiberglass with vinyl facing - scrubability Vinyl Film facing (UV protected)
      b. Pattern: Pattern E-C.
   2. Size: 24 by 24 inches.
   3. Thickness: 1" inches.
   4. Light Reflectance: .87 percent, determined in accordance with ASTM E1264.
   5. NRC Range: .80, determined in accordance with ASTM E1264.
   6. Tile Edge: Square, where indicated on Finish Schedule as Lay-in Acoustical ceiling
   7. Color: White.

8. Suspension System: Exposed grid.
9. Products: Armstrong World Industries, Inc.: "Pebble" # 2988

B. Water-Felted Vinyl Faced Gypsum, Water Resistant Ceiling - Wet Locations, Toilet Rooms, Kitchen - Reference Finish Schedule
1. Classification: ASTM E1264 Type III. Clean Room
2. Size: 24 by 24 inches.
3. Light Reflectance: .77 percent, determined in accordance with ASTM E1264.
4. Ceiling Attenuation Class (CAC): .35, determined in accordance with ASTM E1264.
5. Panel Edge: Square.
6. Color: White.
7. Suspension System: Exposed grid.
8. Products: USG Corporation: Sheet Rock #3260

C. Acoustical Panels - Fine Fissured, Tegular Edge 2 x 2 Panels - For use in Offices & Conference rooms - Reference Finish Schedule
1. Classification: ASTM E1264 Type IV.
2. Size: 24 by 24 inches.
3. Panel Edge: Tegular, where located on Finish Schedule as Lay-in Tegular
4. Color: White.
5. Suspension System: Exposed grid.
6. Products: Armstrong World Industries, Inc.: "Pebble #2988"

D. Acoustical Panel Clouds: Glass fiber panels suspended by hanger wire or rods attached to anchor points on panel back. - Ecophon - Solo Freedom Ellipse Clouds - for use in the elementary school library area - Reference Finish Schedule.
1. Classification: ASTM E1264 Type XII.
   a. Form: 2, cloth.
   b. Pattern: "G" - smooth.
2. Size and Configuration: As indicated on drawings.
3. Shape: Custom Ellipse shape.
4. Thickness: 40 mm.
5. Panel Edge: fully painted - square.
6. Color: Three (3) colors minimum; to be selected and approved by architect.
7. Products:
   a. CertainTeed Corporation; Ecophon Solo Cloud: www.certainteed.com/ceilings-and-walls/#sle.

E. Acoustical Panel Clouds: Acoustical panel clouds with mineral fiber acoustical media backing suspended by hanger wire attached to Axiom Classic Cloud Trim & Edging. - For use in High School Corridor - Reference Finish Schedule for configuration and sizes of cloud.
1. Classification: ASTM E1264 Type III.
   a. Pattern: "C" - perforated, small holes.
2. Size and Configuration: As indicated on drawings made up of Fine Fissured # 1821 Beveled Edge
3. Thickness: Axiom edge : 6" edge, Pebble #2988 - 15/16"
4. Products:
   a. Armstrong World Industries: Armstrongceilings.com/axiomclassic

2.03 SUSPENSION SYSTEM(S)

A. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 9/16 inch face width.

3. Finish: Baked enamel.
4. Color: White. (Architect reserves the right to choose a color from standard colors for some locations)
5. Products:
   a. USG Corporation; Donn Brand Centricitee DXT/DXLT 9/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.

B. Exposed Suspension System, Steel Direct Hung exposed system: Hot-dipped galvanized steel grid.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Main Tee; 15/16 inch face width,
3. Main Tee: 13.5 lbs/LF at 4' hanger spacing
4. Cross Tee: 12.25 lbs/LF at 4' hanger spacing
5. Wall Angle: Match Grid square edge - caulk to wall
6. Finish: Baked enamel.
7. Color: White.(Architect reserves the right to choose a color from standard colors for some locations)
8. Products: Equal to but not limited to Armstrong "Prelude XL" 7300 Series

C. Exposed Suspension System for "Cloud" Applications: Galvanized steel grid and cap; trim as specified under Accessories.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Products:
   a. USG Corporation; Compositions Decorative Cloud System: www.usg.com/ceilings/#sle.- Ecophon Solo system
   b. Armstrong World Industries: Axiom Classic Trim: www.armstrongceilings.com/axiomclassic
5. Reference A703 for details.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit wind uplift applications at areas within 20' of an exterior door.

D. Perimeter Moldings: Same metal and finish as grid.
1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
2. Shadow Molding: Shaped to create a perimeter reveal.
3. Channel Molding: U-shaped, for hold-down type installations.

E. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.

F. Acoustical Insulation: Specified in Section 072100.
1. Thickness: 6 inch total thickness, 2 layers of 3" insulation
2. Size: To fit acoustical suspension system, each layer in opposite direction of the underlying layer, in rolls, not cut to fit tiles.

G. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 Preparation

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size, or as shown on reflected ceiling plan - 45 deg. angled layout in some areas.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis. - some areas may have an angled lay-out - Reference Reflected ceiling plans.

D. Fit border trim neatly against abutting surfaces.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.

I. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 SCHEDULE

A. Refer to the reflected ceiling plan in the construction documents and the Finish Schedule in this project manual for location of ceiling types.

END OF SECTION 095100

SECTION 096429 - WOOD STRIP AND PLANK FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood strip and plank flooring, nailed.

B. Secondary subflooring.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete subfloor surface.

B. Section 061000 - Rough Carpentry: Wood overlay subfloor surface.

1.03 REFERENCE STANDARDS

A. ASTM D3676 - Standard Specification for Rubber Cellular Cushion Used for Carpet or Rug Underlay 2018.

B. NWFA (IG) - Installation Guidelines Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate floor joint pattern and termination details.

C. Samples: Submit two samples 8 by 10 inch in size illustrating floor finish, color, and sheen.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.

B. Provide heat, light, and ventilation prior to installation.

C. Store materials in area of installation for minimum period of 24 hours prior to installation.

D. Maintain minimum room temperature of 65 degrees F for a period of two days prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hardwood Strip and Plank Flooring:
   1. Substitutions: Section 016000 - Product Requirements.

2.02 MATERIALS

A. Wood Strip Flooring:
   1. Species: oak.
   2. Grade: Clear.
   3. Cut: Edge grain.
   4. Moisture Content: 7 to 9 percent.
   5. Actual Thickness: 3/4 inch.
   6. Actual Width: 2-1/4 inches.
   7. Edge: Tongue and groove.
   8. End: End matched.
   9. Length: Random, minimum of 9 inches.
   10. Treatment: Acrylic impregnated.

B. Secondary Subflooring: 23/32 inch thick plywood, with tongue and groove edges; Exposure 1, sanded, preservative treated.

C. Sheathing Paper: Plain building paper.

2.03 ACCESSORIES

A. Sound Control Underlayment: Recycled rubber or cork type complying with ASTM D3676.
   1. Thickness: 1/8 inch, nominal and fill cavity of framing system with loose fill fiberglass insulation.

B. Wood Plugs: Round shape, 3/4 inch diameter by 1/8 inch thick, of same species as flooring.

C. Divider Strip: Angle; mill finish aluminum.

D. Transition Strip: Same species and finish as flooring material; profiles indicated.

E. Floor Finish: Polyurethane, to achieve high gloss surface; type recommended by flooring manufacturer.

F. Floor Stain: penetrating type recommended by flooring manufacturer.

G. Sealer and Wax: Types recommended by flooring manufacturer.

2.04 SOURCE QUALITY CONTROL

A. Inspect and stamp species and grade on underside of each piece of wood flooring at factory.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify wood subfloor is properly secured, smooth and flat to plus or minus 1/4 inch in 10 feet.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Secondary Subflooring: Place plywood subflooring over sleepers.
   1. Lay perpendicular to the sleepers, with end joints over sleepers, and nail at 12 inches on center.

B. Prepare substrate to receive wood flooring in accordance with manufacturer's and NWFA instructions.

C. Broom clean substrate.

3.03 INSTALLATION

A. Sheathing Paper: Place over wood subfloor; lap edges and ends 2 inches, staple in place.

B. Underlayments: Install in accordance with underlayment manufacturer's instructions.

C. Wood Flooring:
   1. Install in accordance with manufacturer's and NWFA instructions; predrill and blind nail to subfloor.
   2. Lay flooring parallel to length of room areas. Verify alignment as work progresses.
   3. Arrange flooring with end matched grain set flush and tight.
   4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
   5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
   6. Secure edge strips before installation of flooring with stainless steel screws.
   7. Install flooring tight to floor access covers.
   8. Provide 1/2 inch expansion space at fixed walls and other interruptions.

D. Finishing:
   1. Mask off adjacent surfaces before beginning sanding.
   2. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
   3. Apply finish in accordance with floor finish manufacturer's instructions.
   4. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
   5. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.
   6. Apply last coat of finish.

3.04 CLEANING

A. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

3.06 SCHEDULES

A. Cafeteria Stage & Ramps: Oak, random length strip, nailed to wood subfloor, two coat varnish finish.

END OF SECTION 096429

SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient MCT tile flooring.

B. Resilient base.

C. Resilient corner guard accessories.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).

B. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

C. ASTM F2195 - Standard Specification for Linoleum Floor Tile 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, in size illustrating color and pattern for each resilient flooring product specified.

E. Installer's Qualification Statement.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Wall Base: 10 linear feet for each five-hundred (500) of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience.

C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Linoleum Tile: MCT ESSENTIALS & ELEMENTS Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
   1. Manufacturers:
      a. Forbo Flooring, Inc: www.forboflooringna.com/#sle. Forbo Rep: Becky Richardson 1-469-430-5640; becky.richardson@forbo.com
   2. Minimum Requirements: Comply with ASTM F2195, Type corresponding to type specified.
   3. Backing: polyester.
   4. Thickness: 080" - (2.0mm), minimum, excluding backing.
   5. Tile Size: 13.1 X 13.1 inches.
   6. Pattern: Solid color tiling pattern may be selected by Architect with a variety of colors and patterns on each floor - may have up to 4 or more colors per pattern.
   7. Color: To be selected by Architect from manufacturer's full range.

2.02 RESILIENT BASE

A. Resilient Base - Cove with top-set toe: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled & Corner Guards
   1. Manufacturers:
      a. Tarkett Company: www.commercial.tarkett.com/#sle.
      b. Roppe Corporation; 700 Series: www.roppe.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
   2. Rubber Base Height: 4 inch
   3. Corner Guard: 2 3/4" width (Roppe # 19 corner guard)
   4. Thickness: 0.125 inch.
   5. Finish: Matte.
   6. Length: Rolls/Coils in lengths standard with manufacturer, but not less than 96 feet..

7. Color: To be selected by Architect from manufacturer's full range.
8. Accessories: Premolded external corners and internal corners.

2.03 ACCESSORIES

A. Moldings, Transition and Edge Strips & Corner Gards : same material as rubber base.
   1. Manufacturers:
      a. Tarkett Company: www.commercialtarkett.com.
      b. Roppe Corporation: www.roppe.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 Installation - General

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 Installation -MCT Tile Flooring

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Install tile to a pattern as selected by architect . Allow minimum 1/2 full size tile width at room or area perimeter allow for multiple colors for tile pattern.

3.05 Installation - Resilient Base

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

3.08 SCHEDULE

A. Refer to the "Finish Schedule" in Section 099990 for locations of Resilient items.

END OF SECTION 096500

SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, installed with glue dots..

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.

C. CRI 104 - Standard for Installation of Commercial Carpet 2015.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Submit two, 12 inch long samples of edge strip and base cap.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
1. Shaw Contract Group: www.shawcontract.com.
2. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot. Subject to compliance with requirements, provide one of the following:
1. Product: BASALT II TILE - WALK IN THE GARDEN # 5T198 manufactured by Shaw Contract Group.
2. Product: VAPOR TILE - MATERIAL MATTERS # 5T036 manufactured by Shaw Contract Group.
3. Tile Size: nominal to the style group selected.
4. Pile Thickness: .101 inch for finished carpet tile according to ASTM D6859.
5. Color: as selected by the Owner and Architect.
6. Lay Pattern: to be selected once exact tile is selected by Owner and Architect..
7. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
8. Static Control Fiber: Eco Solution QNylon or Solution Q Extreme Nylon.
9. Gauge: 1/12 inch.
10. Stitches: 11 per inch.
11. Pile Weight: 17-18 oz/sq yd.
12. Primary Backing Material: Synthetic.
13. Secondary Backing Material: Ecoworx Tile.
14. Protective Treatment: SSP Shaw Soil Protection

2.03 ACCESSORIES

A. Carpet Tile Adhesive:
1. Products:
a. Shaw Contract Group; LokDots.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove any existing floor covering .

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Locate change of color or pattern between rooms under door centerline.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION 096813

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SECTION 097200 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering mural as produced by KOROSEAL - artwork to be determined

B. Reference Allowances for wall murals

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive & protective coating

C. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

1.05 MOCK-UPS

A. Provide panel, artwork graphics, illustrating installed wall covering and joint seaming technique.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 Wall Coverings

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

B. Wall Covering Mural: Fabric-backed vinyl.
   1. Comply with ASTM F793/F793M, Category V, Type II.
   2. Overcoating: Manufacturer's liquid lamination special coating.
   3. Manufacturers:
      a. Koroseal/RJF International: www.koroseal.com/#sle. contact Product Representative - RenataOliveria Territory Sales 1-469-693-8739 or roliveira@koroseal.com

C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

D. Termination Trim: Extruded plastic, clear.

E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

F. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

F. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

D. Butt edges tightly.

E. Horizontal seams are not acceptable.

F. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

G. Install termination trim. 1 X 2 wood trim at top of wall and 1 X 4 wood trim at base.

H. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION 097200

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SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Mechanical and Electrical:

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting.

B. Section 099300 - Staining and Transparent Finishing. Wood substrates.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

B. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

C. SSPC-SP 2 - Hand Tool Cleaning 2018.

D. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

B. Paints:
   1. PPG Paints: www.ppgpaints.com/#sle.
   2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
1. One coat of alkyd primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

B. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

C. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

D. Paint ME-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

E. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

F. Paint MgE-OP-3L - Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

G. Paint E-Pav - Pavement Marking Paint:
1. One coat, with reflective particles - color to be selected by architect.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer; MPI #3.
a. Products:
1) PPG Paints Series Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #3)
2) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)
3) Sherwin-Williams Loxon Water Blocking Primer/Finish.
2. Anti-Corrosive Alkyd Primer for Metal; MPI #79.

a. Products:
1) PPG Paints 7-Line Interior/Exterior Rust Inhibitive Steel Primer, 7-852 Series. (MPI #79)
2) PPG Paints Multiprime Multi-Purpose Primer, 4160 Series. (MPI #79)

3. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
a. Products:
1) PPG Paints Multiprime Multi-Purpose Primer, 4160 Series. (MPI #76)

4. Alkyd Primer for Galvanized Metal.
a. Products:

5. Water Based Primer for Galvanized Metal; MPI #134.
a. Products:
1) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series. (MPI #134)
2) Sherwin-Williams DTM Primer/Finish (MPI #134)
3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #134)

6. Rust-Inhibitive Water Based Primer; MPI #107.
a. Products:
1) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series.
2) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #107)

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.06 SCHEDULE - PAINT SYSTEMS

A. Steel Fabrications: Finish surfaces exposed to view.
   1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.

B. Galvanized Steel: Finish surfaces exposed to view.
   1. Exterior: Paint MgE-OP-3A, gloss.

C. Shop-Primed Metal Items: Finish surfaces exposed to view.
   1. Finish the following items:

a. Mechanical equipment.
b. Electrical equipment.

2. Exterior: Paint-ME-OP-2A, semi-gloss.

D. Exterior Pavement Markings: Paint E-Pav.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Surfaces inside cabinets.
   3. Prime surfaces to receive wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. Paint surfaces of air ducts that are visible with one coat of flat black paint to visible surfaces.
      c. Paint dampers exposed behind louvers, grilles, to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Floors, unless specifically indicated.
   7. Glass.
   8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

B. Section 099300 - Staining and Transparent Finishing: Wood substrates.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

C. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

D. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.05 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 12 " long by 12" wide, illustrating paint color, texture, and finish. - Texture is to be approved by architect from multiple selections

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

B. Paints:
   1. Base Manufacturer: .
   2. PPG Paints: www.ppgpaints.com/#sle.
   3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - EXTERIOR / INTERIOR

A. Exterior or Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
   1. Exterior Paint Concrete and one coat primer.
      a. 1st & 2nd Coats: A06W00151-A100 Exterior Latex Flat

   2. Ferrous Metal
      a. 1st coat: B66W00011-Pro Industrial DTM Acrylic Primer
      b. 2nd & 3rd Coat: B66W01151- Pro industrial DTM Acrylic Semi Gloss Coating.
   3. Top Coat(s): Interior Latex.
      a. Gypsum Board Ceilings Products:
         1) PPG Paints Speedhide Interior Latex, 6-3511 Series, Satin. (MPI #52)
         2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
         3) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eggshell. (MPI #52)

4. Top Coat(s): Interior Low Odor/VOC Modified Acrylic Metallic Paint.
   a. Products:
      1) Modern Masters by Rust-Oleum Corporation Metal Effects: www.rustoleum.com/#sle.
5. Top Coat Sheen:
   a. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
   b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Two top coats and one coat primer.
2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
   a. Products:
      1) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.

C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
   a. Products:
      1) PPG Paints Aquapon WB EP Two-Component Waterborne Epoxy Coating, 98E-1/98E-100 Series, Semi-Gloss. (MPI #215)
      2) PPG Paints Aquapon WB EP Two-Component Waterborne Epoxy Coating, 98E-1/98E-98 Series, Gloss. (MPI #115)
      3) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, Gloss. (MPI #115)

D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping
1. Shop primer by others.
2. One top coat.
3. Top Coat: Alkyd Dry Fall; MPI #55, 89, or 225.
   a. Products:
      1) PPG Paints Speedhide Interior Alkyd Dry Fog, 6-160XI, Flat. (MPI #55)
      2) PPG Paints Speedhide Super Tech Interior Alkyd Dry Fog, 6-151XI, Eggshell.
      3) Sherwin-Williams Dryfall Flat. (MPI #55)
      4) Sherwin-Williams Super Save-Lite Dryfall, Semi-Gloss. (MPI #89)

E. Paint CI-OP-3A - Concrete/Masonry, Opaque, Alkyd, 3 Coat:
1. One coat of block filler.
2. Semi-gloss: Two coats of alkyd enamel.
3. Flat: Two coats of alkyd enamel.

F. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
1. One coat of block filler.
2. Semi-gloss: Two coats of latex enamel.
3. Flat: Two coats of latex enamel.

G. Paint MI-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
1. One coat of alkyd primer.
2. Gloss: Two coats of alkyd enamel.
3. Semi-gloss: Two coats of alkyd enamel.

H. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. One coat of latex primer.
   2. Gloss: Two coats of latex enamel.
   3. Semi-gloss: Two coats of latex enamel.

I. Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with alkyd primer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

J. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with latex primer.
   2. Gloss: Two coats of latex enamel.
   3. Semi-gloss: Two coats of latex enamel.

K. Paint MgI-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
   1. One coat galvanize primer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.

L. Paint MgI-OP-3L - Galvanized Metals, Latex, 3 Coat:
   1. One coat galvanize primer.
   2. Gloss: Two coats of latex enamel.
   3. Semi-gloss: Two coats of latex enamel.

M. Paint CI-OP-3Af - Concrete/Masonry, Alkyd Floor Enamel, 3 Coat:
   1. One coat of alkali-resistant primer.
   2. Gloss: Two coats of alkyd floor enamel.

N. Paint CI-OP-3E - Concrete/Masonry, Epoxy Enamel, 3 Coat:
   1. One coat of catalyzed epoxy primer.
   2. Gloss: Two coats of catalyzed epoxy enamel.

O. Paint GI-OP-3A - Gypsum Board/Plaster, Alkyd, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Gloss: Two coats of alkyd enamel.
   3. Semi-gloss: Two coats of alkyd enamel.
   4. Eggshell: Two coats of alkyd enamel.

P. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Gloss: Two coats of latex enamel.
   3. Semi-gloss: Two coats of latex enamel.
   4. Eggshell: Two coats of latex enamel.

Q. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Gloss: Two coats of latex-acrylic enamel.
   3. Semi-gloss: Two coats of latex-acrylic enamel.
   4. Eggshell: Two coats of latex-acrylic enamel.

R. Paint GI-P-2A - Gypsum Board/Plaster, Alkyd Primer, 2 Coat:
   1. Two coats of alkyd primer sealer.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Alkali Resistant Water Based Primer; MPI #3.
      a. Products:
         1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #3)
         2) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)
         3) Sherwin-Williams Loxon Water Blocking Primer/Finish.
   2. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
      a. Products:
         1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #149)
         2) PPG Paints Pure Performance Interior Latex Primer, 9-900. (MPI #149)
   3. Interior/Exterior Latex Block Filler; MPI #4.
      a. Products:
         1) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI . (MPI #4)
         2) Sherwin-Williams ConFlex Block Filler. (MPI #4)
         3) Sherwin-Williams Loxon Block Surfacer. (MPI #4)
   4. Interior Latex Primer Sealer; MPI #50.
      a. Products:
         1) PPG Paints Speedhide Interior Latex Sealer, 6-2. (MPI #50)
         2) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #50)
         3) PPG Paints Pure Performance Interior Latex Sealer, 9-900. (MPI #50).
   5. Interior Drywall Primer Sealer.
      a. Products:
         1) PPG Paints Speedhide Interior Latex Sealer, 6-2.
   6. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
      a. Products:
         1) PPG Paints Multiprime Multi-Purpose Primer, 4160 Series. (MPI #79)
   7. Interior Rust-Inhibitive Water Based Primer; MPI #107.
      a. Products:
         1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series.
         2) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #107)
   8. Interior Water Based Primer for Galvanized Metal; MPI #134 or #134 X-Green.
      a. Products:
         1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series. (MPI #134)
   9. Alkyd Primer for Galvanized Metal.
      a. Products:
         1) PPG Paints Speedhide Interior/Exterior Galvanized Steel Primer, 6-209 Series.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Galvanized Surfaces:

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

B. Inspect and test questionable coated areas.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Concrete, Concrete Masonry Units (CMU), Concrete Block, Brick Masonry: Finish surfaces exposed to view.
1. Interior: CI-OP-3L, semi-gloss.

B. Gypsum Board: Finish surfaces exposed to view.
1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.

2. Interior Walls: GI-OP-3A, semi-gloss.

C. Steel Doors and Frames: Finish surfaces exposed to view; MI-OP-3A, gloss.

D. Steel Fabrications: Finish surfaces exposed to view.

E. Wall Surfaces Under Vinyl Wall Covering: Level 5 surface & prime only no texture or paint

F. Pipe and Duct Insulation Jackets: Finish surfaces exposed to view; FI-OP-2L, flat.

END OF SECTION 099123

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SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting:

B. Section 099123 - Interior Painting:

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

B. SCAQMD 1113 - Architectural Coatings 1977, with Amendment (2016).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category.

C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide finishes from the same manufacturer to the greatest extent possible.

B. Transparent Finishes:
1. PPG Paints: www.ppgpaints.com/#sle.
2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Stains:
1. PPG Paints: www.ppgpaints.com/#sle.
2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 Stains and Transparent FINISHES - GENERAL

A. Finishes:
1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each finish material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Flammability: Comply with applicable code for surface burning characteristics.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.

2.03 Interior STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood - Vertical Surfaces:
1. Stain: Semi-Transparent Stain for Wood, Solvent Based; MPI #90.
   a. Products:
      1) PPG Paints Deft Interior Oil-Based Fast Dry Stain, DFT570 Series. (MPI #90)
      2) PPG Paints Deft Interior Oil-Based Wood Stain, DFT400 Series. (MPI #90)
2. Stain: Semi-Transparent Stain for Wood, Water Based; MPI #186.
   a. Products:

1) PPG Paints Deft Interior Water-Based Wood Stain, DFT300 Series. (MPI #186)

B. Finish on Wood - Floors.
1. Stain: Semi-Transparent Stain for Wood; MPI #90.
a. Products:
1) PPG Paints Deft Interior Oil-Based Fast Dry Stain, DFT570 Series. (MPI #90)
2) PPG Paints Deft Interior Oil-Based Wood Stain, DFT400 Series. (MPI #90)
2. Sealer: Water-Based, Clear or Light Amber.
3. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

E. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

F. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099300

FINISH SCHEDULE - GORDON ISD - CAMPUS ADDITIONS AND RENOVATIONS - PROJECT # 20864.00

	ROOM NO	FLR.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
CANOPY	100	1B	–	3H	3H	3H	3H	4I	12' / 13'	
ENTRY	101	1B	–	3H	3H	–	3H	4I	10'	
VESTIBULE	102	1A	2B	3I	3I	3I	3I	4G	10'	R3, R8, R11
RECEPTION	103	1A/1E	2A	3E	3E	3E	3E	4A	10'	R17
OFFICE	104	1E	2A	3E	3E	3E	3E	4A	9'	R5, R17
TOILET	105	1A	2B	3D	3D	3D	3D	4G	10'	R3, R4, R15
TOILET	106	1A	2B	3D	3D	3D	3D	4G	10'	R3, R4, R15
TOILET	107	1A	2B	3C	3E	3C	3C	4G	9'	R2, R3, R4, R11, R15
TOILET	108	1A	2B	3C	3C	3C	3E	4G	9'	R2, R3, R4, R11, R15
STAFF	109	1C	2A	3E,R9	3E	3E	3E	4A	10'	R5, R9
OFFICE	110	1E	2A	3E	3E	3E	3E	4A	9'	R17
CLOSET	111	1E	2A	3E	3E	3E	3E	4E	9'	R17
CLOSET	112	1E	2A	3E	3E	3E	3E	4E	9'	R17
OFFICE	113	1E	2A	3E	3E	3E	3E	4A	9'	R5, R17
VAULT	114	1E	2A	3G	3G	3G	3G	4A	9'	
CLOSET	115	1E	2A	3E	3E	3E	3B	4A	9'	
PRINCIPAL	116	1E	2A	3E	3E	3E	3E	4A	9'	R5, R17
SPED. ROOM	117	1C	2A	3E	3E	3E	3E	4A	9'	R17
OFFICE	118	1E	2A	3E	3E	3E	3E	4A	9'	R17
SPED. ROOM	119	1C	2A	3E	3E	3E	3E	4A	9'	R9, R17

FINISH SCHEDULE - GORDON ISD - CAMPUS ADDITIONS AND RENOVATIONS - PROJECT # 20864.00

	ROOM NO	FLR.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
TOILET	120	1A	2B	3D	3D	3D	3D	4G	10'	R3, R4, R15
TOILET	121	1A	2B	3D	3D	3D	3D	4G	10'	R3, R4, R15
VESTIBULE	122	1A	2B	3I	3I	3I	3I	4G	10'	R3, R8, R11
CORRIDOR	123	1C	2A	3E	3B/3E	3B/3E	3E	4A	10'	R1, R6, 15
WORK AREA	124	1C	2A	3E	3E	3E	3E	4A	10'	R1, R17
CLASSROOM	125	1E	2A	3E	3E	3E	3E	4A	10'	R5
CLASSROOM	126	1E	2A	3E	3E	3E	3E	4A	10'	R5
CLASSROOM	127	1E	2A	3E	3E	3E	3E	4A	10'	R5
CLASSROOM	128	1E	2A	3E	3E	3E	3E	4A	10'	R5
CLASSROOM	129	1E	2A	3G	3G	3G	3G	4A	9'	
OFFICE	130	1E	2A	3E	3E	3G	3E	4A	9'	
STORAGE	131	1C	2A	3E	3B	3B	3E	4A	9'	
STORAGE ROOM	132	1C	2A	3E	3E	3E	3B	4G	10'	R1
SCIENCE CLASSROOM	133	1C	2A	3E	3E	3G	3B	4G	10'	R1, R5, R26
MULTIPURPOSE	134	1C	2A	3G	3G	3G	3E	4A	9'	R1
MECHANICAL	135	1B	2A	3E	3E	3E	3E	4B	10'	R8, R10, R13, R22
CLASSROOM	136	1E	2A	3G	3G	3G	3G	4A	9'	
CLASSROOM	137	1E	2A	3E	3E	3G	3E	4A	10'	R5
CLASSROOM	138	1E	2A	3E	3E	3E	3E	4A	10'	R5
CLASSROOM	139	1E	2A	3E	3E	3E	3E	4A	10'	

FINISH SCHEDULE - GORDON ISD - CAMPUS ADDITIONS AND RENOVATIONS - PROJECT # 20864.00

	ROOM NO	FLR.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
COMPUTER LAB	140	1E	2A	3E	3E	3E	3E	4A	10'	R10, R27
WORK AREA	141	1C	2A	3E	3E	3E	3E	4A	10'	R1
CORRIDOR	142	1C	2A	3I	3I	3I	3I	4E/4D	16' / 12'	R1, R6, R15
CORRIDOR	143	1C	2A	3I	3I	3I	3I	4A	9'	R1, R15
CORRIDOR	144	1C	2A	3I	3I	–	3I	4A	10'	R1, R15, R16
CORRIDOR	145	1C	2A	3I	3I	–	3I	4A	10'	R1, R15, R16
CORRIDOR	146	1C	2A	3I	3I	3I	3I	4A	10'	R1, R15, R16
CORRIDOR	147	1C	2A	3I	3I	3I	–	4A	10'	R1, R16, R17
CORRIDOR	148	1C	2A	3I	3I	3I	–	4A	10'	R1, R17
CORRIDOR	149	1C	2A	3I	3I	3I	3I	4A	10'	R1, R15, R16
CORRIDOR	150	1C	2A	3I	3I	3I	3I	4A	10'	R1, R15
CORRIDOR	151	1C	2A	3I	3I	3I	3I	4A	9'	R1, R15
STORAGE	152	1C	2A	3E	3E	3E	3E	4A	9'	
TOILET	153A	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4, R11, R15
NURSE	153	1C	2A	3E	3E	3E	3E	4A	9'	R9, R11
CORRIDOR	154	1C	2A	3I	3I	3I	3I	4A	9'	R1, R6, R15, R18
CORRIDOR	155	1C	2A	3I	3I	3I	3I	4A	9'	R1, R8, R15
VESTIBULE	156	1A	2B	3I	3I	3I	3I	4G	9'	R3, R8, R11, R15
VESTIBULE	157	1C	2A	3I	3I	3I	3I	4A	9'	R1, R17
LIBRARY	158	1C	2A	3E/3F	3E	3E	3E	4E/4I	10'/9'-6"	R1, R5, R17, R18, R28
CORRIDOR	159	1C	2A	3I	3I	3I	3I	4A	9'	R1, R6, R15

FINISH SCHEDULE - GORDON ISD - CAMPUS ADDITIONS AND RENOVATIONS - PROJECT # 20864.00

	ROOM NO	FLR.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
CORRIDOR	160	1C	2A	3I	3I	3I	3I	4A	9'	R1, R17, R18, R15
VESTIBULE	161	1A	2B	3I	3I	3I	3I	4G	9'	R3, R8, R11, R15
CORRIDOR	162	1C	2A	3I	3I	3I	3I	4A	9'	R1, R17, R15
CORRIDOR	163	1C	2A	3I	3I	3I	3I	4A	9'	R1, R15, R28
CORRIDOR	164	1C	2A	3I	3I	3I	3I	4A	9'	R1, R17, R15
VESTIBULE	165	1A	2B	3I	3I	3I	3I	4G	9'	R3, R8, R11, R15
CANOPY	166	1B	--	3H	3H	3H	3H	4I	12' / 13'	
TOILET	167	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
TOILET	168	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
TOILET	169	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
TOILET	170	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
VESTIBULE	171	1A	2B	3I	3I	3I	3I	4G	9'	R3, R4
TOILET	172	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4
TOILET	173	1A	2B	3D	3D	3D	3D	4G	9'	R3, R4
CLASSROOM	174	1E	2A	3E	3E	3E	3A/3B	4A	9'-6"	R7, R12, R17, R23, R25,
CLASSROOM	175	1E	2A	3E	3E	3E	3A/3B	4A	9'-6"	R7, R12, R17, R23
WORK AREA	176	1C	2A	3E	3E	3E	3E	4A	9'-6"	R1
CLASSROOM	177	1E	2A	3B/3E	3E	3A/3E	3B/3E	4A	9'-6"	R7, R12, R23, R25
CLASSROOM	178	1E	2A	3E	3E	3A/3E	3B/3E	4A	9'-6"	R7, R12, R17, R23
OFFICE	179	1E	2A	3E	3E	3E	3E	4A	9'	R17, R24
CLOSET	179A	1E	2A	3E	3E	3E	3E	4E	9'	

FINISH SCHEDULE - GORDON ISD - CAMPUS ADDITIONS AND RENOVATIONS - PROJECT # 20864.00

	ROOM NO	FLR.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
OFFICE	180	1E	2A	3E	3E	3E	3E	4A	9'	R24
CLOSET	180A	1E	2A	3E	3E	3E	3E	4E	9'	R24
CLASSROOM	181	1E	2A	3E	3E	3A/3B	3E	4A	9'-6"	R5, R7, R12, R23
CLASSROOM	182	1E	2A	3E	3E	3A/3B	3E	4A	9'-6"	R7, R12, R23
SPED	183	1C	2A	3E	3E	3E	3E	4A	9'-6"	R1
CLASSROOM	184	1E	2A	3E	3A/3B	3E	3E	4A	9'-6"	R7, R23
ELEMENTARY SCIENCE	185	1C	2A	3E	3E	3B	3E	4A	9'-6"	R1, R11, R26
CLASSROOM	186	1E	2A	3E	3E	3E	3E	4A	9'-6"	R12
CLASSROOM	187	1E	2A	3E	3E	3E	3E	4A	9'-6"	R12
CORRIDOR	188	1C	2A	3I	3I	3I/3F	3I	4A/4C/4H	9'	R1, R15, R28
CAFETORIUM	190	1C	2A	3E	3E	3E	3E	4A	10'	R1, R11, R17, R20
CAFETERIA	189	1C	2A	3I	3I	3I	3I	4A	10'	R1, R11, R17, R15, R20
DISHWASH	191	1D	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
KITCHEN	192	1D	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
PANTRY	193	1D	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
JANITOR	194	1D	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
SERVING LINE	195	1D	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
JANITOR	196	1D	2B	3D	3D	3D	3D	4G	9'	R15
TOILET	197	1D	2B	3D	3D	3D	3D	4G	9'	R3, R4, R15
OFFICE	198	1D	2A	3E	3E	3E	3E	4A	9'	R11
WALK-IN FREEZER & COOLER	199	1D	--	--	--	--	--	--		R21
MECHANICAL	200	1B	2A	3E	3E	3E	3E	4B	10'	R13, R22

FINISH SCHEDULE - GORDON ISD - CAMPUS ADDITIONS AND RENOVATIONS - PROJECT # 20864.00

	ROOM NO	FLR.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
MEZZANINE										
MECHANICAL	M200	1B	-	-	-	-	-	-	OPEN	R10, R13,
MECHANICAL	M201	1F	-	-	-	-	-	-	OPEN	R10, R13,
MECHANICAL	M202	1B	-	-	-	-	-	-	OPEN	R10, R13,
AG CTE BUILDING										
ENTRY	AG100	1C	2A	3B	3B	3B	3B	4A	EXISTING	R8, R11, R14
OFFICE	AG101	1C	2A	3B	3B	3B	3B	4A	EXISTING	R14
CLASSROOM	AG102	1C	2A	3B	3B	3B	3A/3B	4A	EXISTING	R14
STORAGE	AG103	1G	2A	-	-	-	-	-	EXISTING	R14
A/H AREA	-	1G	-	-	-	-	3A	-	EXISTING	R14
TOILET	AG104	1A	2B	3D	3D	3D	3D	4G	9'	R14
SHOP	AG105	1G	-	-	-	-	-	-	EXISTING	R14
STORAGE	AG106	1G	-	-	-	-	-	-	EXISTING	R14
STORAGE	AG107	1G	2A	3B	3B	3B	3B	4G	EXISTING	R14

SECTION 099999 - FINISH SCHEDULE KEY

1. **FLOORS**
   - **1A.** CERAMIC TILE (R3)
   - **1B.** EXPOSED CONCRETE FLOOR
   - **1C.** MCT
   - **1D.** QUARRY / PORCELAIN TILE (NON-SLIP)
   - **1E.** CARPET TILE
   - **1F.** MECHANICAL WOOD DECK – PAINT TO SEAL WOOD
   - **1G.** EXISTING FLOORING TO REMAIN

2. **BASE**
   - **2A.** RUBBER COVE BASE
   - **2B.** GLAZED CERAMIC TILE BASE

3. **WALLS**
   - **3A.** EXISTING WINDOW OR DOOR OPENING – PAINT FRAME AND DOOR WHERE OCCURS
   - **3B.** PAINT
   - **3C.** GLAZED CERAMIC TILE WAINSCOT (4'-0"H) – PROVIDE MULTI-COLORED PATTERN (R2)
   - **3D.** GLAZED CERAMIC TILE – FULL HEIGHT- PROVIDE MULTI COLOR PATTERN
   - **3E.** GYPSUM BOARD - TEXTURE AND PAINT
   - **3F.** ACCENT WALL MURAL
   - **3G.** BLOCK FILL AND PAINT CMU AS SPEC.
   - **3H.** MASONRY / EIFS
   - **3I.** GYP. BD. W/ CERAMIC TILE WAINSCOT TO 72" AFF. – PROVIDE W/ SCHLUTER CORNERS AND PATTERN – GYP. BD. ABOVE WAINSCOT – TEXTURE AND PAINT (R4)

4. **CEILING**
   - **4A.** 2' x 2' LAY-IN ACOUSTICAL CEILING w/ 3½" BATT INSULATION ABOVE
   - **4B.** 2' x 2' FIRE GUARD 1 HOUR RATED LAY-IN ACOUSTICAL CEILING WITH 3½" BATT INSULATION ABOVE
   - **4C.** EXPOSED ROOF STRUCTURE - PAINT
   - **4D.** CLOUD CEILING PANELS W/ GYP. BD. ABOVE – TEXUTRE AND PAINT GYP. BD.
   - **4E.** PAINTED GYPSUM BOARD
   - **4F.** 2'X2' LAY-IN TEGULAR ACOUSTICAL CEILING w/ 3½" BATT INSULATION ABOVE
   - **4G.** VINYL COVERED GYPSUM -CLEAN ROOM- 2' x 2' LAY-IN ACOUSTICAL CEILING w/ 3½" BATT INSULATION ABOVE
   - **4H.** ECOPHONE FREEDOM SOLO CLOUDS SUSPENDED W/ GYP. BD. CEILING ABOVE – PROVIDE COLOR OPTIONS FOR CLOUD.
   - **4I.** EIFS SOFFIT

REMARKS
- **R1.** MCT WITH ACCENT BORDER AND/OR PATTERN COMPOSED OF CONTRASTING COLORS. THE COLORS AND DESIGN OF THE ACCENT BORDER/PATTERN SHALL BE AS SELECTED BY THE ARCHITECT.
- **R2.** GYPSUM BOARD WALL ABOVE THE CERAMIC TILE WAINSCOT – EPOXY PAINT.

R3. GLAZED CERAMIC FLOOR TILE WITH ACCENT BORDER AND/OR PATTERN COMPOSED OF CONTRASTING COLORS. THE COLORS AND DESIGN OF THE ACCENT BORDER/PATTERN SHALL BE AS SELECTED BY THE ARCHITECT.

R4. GLAZED CERAMIC WALL TILE WALL WITH AN ACCENT BAND AND/OR PATTERN COMPOSED OF CONTRASTING COLORS. THE COLORS AND DESIGN OF THE ACCENT BAND/PATTERN SHALL BE AS SELECTED BY THE ARCHITECT.

R5. GYPSUM BOARD OR CMU FURRING AROUND STEEL COLUMN – PAINT

R6. CERAMIC TILE WIDTH OF EWC WALL WAINSCOT HEIGHT 6'0 WITH PATTERN (R4) OR AT A MINIMUM OF 3' PAST EACH SIDE OF THE EWC COMBO UNIT.

R7. GENERAL NOTE: PROVIDE SOLID SURFACE MATERIAL AT WINDOW SILLS.

R8. GENERAL NOTE: PROVIDE HOLD-DOWN CLIPS FOR THE ACOUSTICAL CEILING AT EXTERIOR DOORS.

R9. CERAMIC TILE BACK SPLASH BETWEEN LOWER & UPPER CABINET

R10. PAINT STEEL HANDRAILS & MISCELLANEOUS STEEL ANGLES, TUBES, BRACKETS AND LINTELS

R11. USE EPOXY PAINT IN TOILET ROOM, WET AREAS & ENTRIES.

R12. CARPET SQUARES MAY HAVE A PATTERN OR BOARDER WITH ACCENT COLORS

R13. STEEL LADDER-PAINT.

R14. EXISTING CEILING HEIGHTS TO REMAIN; HEIGHTS GIVEN ARE FOR REFERENCE ONLY IN EXISTING BUILDING AREA.

R15. PROVIDE SCHLUTER CORNER TRIM AT OUTSIDE CORNERS OF CERAMIC TILE WAINSCOT.

R16. LOCKER BASES TO BE 2A RUBBER BASE – REFERENCE DRAWINGS FOR FURR DOWN OVER LOCKER WITH GYP. BD.

R17. PROVIDE 3" VINYL CORNER TRIM 72" TALL AT OUTSIDE GYP. BD. CORNERS.

R18. NEW "CUBBIE" STYLE STORAGE UNITS TO BE PROVIDED – COORD. FINISHES WITH NUBBIE UNITS.

R19. PLASTIC LAMINATE CABINETRY

R20. WALL PAINT CAN BE UP TO 3 COLORS WITH ACCENT STRIPES OR ORGANIC PATTERN.

R21. DO NOT PAINT ALUMINUM FREEZER UNIT, PROVIDE FURR DOWN ABOVE FREEZER UNIT TO ABOVE CEILING.

R22. PAINT EXPOSED PIPING AS SPEC.

R23. PROVIDE GYP. BD. PATCH AND INFILL ON EXISTING WALL FRAMING TO REMAIN – TEXTURE AND PAINT.

R24. PAINT EXPOSED MASONRY TO REMAIN AS SPEC.

R25. GYP. BD. OVER MTL. STUD INFILL WHERE EXISTING OPENING TO BE INFILLED – TEXTURE AND PAINT.

R26. SCIENCE CASEWORK ON WALLS IN THIS AREA – COORD. FINISHES WITH CASEWORK TO BE PROVIDED.

R27. NEW MILLWORK AND SOLID SURFACE TOP TO BE PROVIDED IN NEW COMPUTER LAB – COORD. FINISHES WITH MILLWORK TO BE PROVIDED.

R28. WALL MURAL TO OCCUR IN THIS AREA – REF. FLOOR PLAN FOR DETAILS.

NOTE: PROVIDE PAINT AS SPECIFIED FOR ALL HOLLOW METAL FRAMES AND DOORS.

END OF SECTION 099999

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

B. Tackboards.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard, tackboard, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations .

D. Test Reports: Show compliance to specified surface burning characteristics requirements.

E. Manufacturer's printed installation instructions.

F. Maintenance Data: Include data on regular cleaning and stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide life of the building warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, staining, and flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.

B. MooreCo, Inc: www.moorecoinc.com/#sle.

2.02 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards: Magnetic, provide as indicated on teh drawings. Coordiante final mounting location with Architect.
   1. Color: As selected from manufacturer's full range.
   2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch .
   3. Core: Fiberboard, 3/8 inch thick, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Height: 48 inches.
   6. Length: As indicated on drawings.
   7. Frame: Extruded aluminum , with concealed fasteners.
   8. Frame Profile: To be chosen from Manufacture range of options.
   9. Frame Finish: Anodized, natural.
   10. Accessories: Provide marker tray, map rail, flag holder, and dry erase kit.

B. Tackboards: Fabric laminated to cork.
   1. Cork Thickness: 1/4 inch.
   2. Fabric: Vinyl coated fabric.
   3. Color: As selected from manufacturer's full range.
   4. Backing: Fiberboard, 3/8 inch thick, laminated to tack surface.
   5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 10, maximum, when tested in accordance with ASTM E84.
   6. Height: 48 inches.
   7. Length: As indicated on drawings.
   8. Frame: Extruded aluminum , with concealed fasteners.
   9. Frame Profile: Manufacturer's standard.
   10. Frame Finish: Anodized, natural.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Vinyl-Coated Fabric: Roll stock, complying with the following:
   1. Total Weight: 13 oz/sq yd.
   2. Color: As selected from manufacture full range of choices.
   3. Pattern: As selected from manufacture full range of choices.
   4. Surface Texture: As selected from manufacture full range of choices.

C. Fiber Board: ASTM C208, cellulosic fiber board.

D. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

E. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall , full width of frame.

B. Map Supports: Formed aluminum sliding hooks and endstops to fit map rail.

C. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

D. Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, bracketed to fit top rail of board.

E. Cleaning Instruction Plate: Provide instructions for markerboard cleaning on a metal plate fastened to perimeter frame near marker rail.

F. Marker Tray: Aluminum, box type, one piece full length of markerboard, closed ends, concealed fasteners, same finish as frame.

G. Dry erase Markermarker kit (#LCS775): one per board .

H. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Install with top of marker tray at 36 inches above finished floor.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

3.04 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

3.05 SCHEDULE

A. As indicated on the drawings.

END OF SECTION 101100

SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior and Exterior directional and informational signs.

C. Luminous egress path marking and other "glow-in-the-dark" signs.

D. Building identification signs.

E. Plaque.

F. Traffic signs (Exterior Metal Signs).

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
1. Best Sign Systems, Inc; Series HC300, 8" x 8": www.bestsigns.com/#sle.
2. Substitutions: See Section 016000 - Product Requirements.

B. Dimensional Letter Signs:
1. A.R.K. Ramos: www.arkramos.com.

C. Plaques:
1. A.R.K. Ramos: www.arkramos.com.

D. Traffic Signs:
1. National Marker Company: www.nationalmarker.com.

2.02 SIGNAGE TYPES & APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes and Texas Accessibility Standards (TAS), unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide Provide 64 signs - room names and numbers to be provided at the time of Submittal review. Provide 4 blank plates - for back of glass mounted signs.
1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Character Height: 5/8 inch. ADA / TAS compliant
4. Size: 8 inches high X 8" wide unless otherwise indicated; Adhesive Applied
5. Signs with slot to identify room names and numbers to be determined later, not those indicated on drawings; in addition, provide "window" section for replaceable occupant name, and the position or department of the office, with a minimum allowance of 3 lines of text.
6. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN" or "RESTROOM", and braille.
   a. Women's Restroom: provide 2 standard
   b. Little Girl : provide 2 child (little girl)
   c. Men's Restroom: provide 2 standard
   d. Little Boy : provide 2 child (little boy)
   e. Uni-sex Restroom: provide 5

f. Child Uni-sex: provide 2 child unisex

C. Interior Directional and Informational Signs:
1. Sign Type: Same as room and door signs.
2. Directional Signs: Allow for 10 signs 12" X 12" for directions with an arrow with a minimum of 4 lines of text and arrows. Wording to be provided at the time of Submittal review.

D. Exterior Directional and Informational Signs.
1. Provide Fiberglass exterior panel signs same style as room and door signs.
2. Provide a total of 10 exterior directional signs, approximately 12 X 18 inches .
3. Allow for 6 rows of text and directional arrows and symbols. (copy and symbols for sign may include: no smoking, no weapons or any other information as provided by the owner.)

E. Building Identification Letters:
1. Use individual metal letters. 12" tall individual letters.
2. Mount on wall in location indicated on drawings.
a. " GORDON ISD PRIMARY "
B. " GORDON ISD SECONDARY "

F. Other Dimensional Letter Signs: Wall-mounted.

2.03 PLAQUES

A. Metal Plaques:
1. Metal: Aluminum casting (#AL-300 satin aluminum raised areas).
2. Metal Thickness: 3/8 inch, minimum.
3. Size: 18 inches by 24 inches.
4. Text and Typeface:
a. Character Font: Times Roman.
b. Character Case: Upper case only.
c. Character Color: Contrast with background color.
5. Border Style: Single line.
6. Background Texture: Pebble.
7. Surface Finish: Brushed, satin.
8. Painted Background Color: Dark bronze #313.
9. Protective Coating: Manufacturer's standard clear coating.
10. Product: A.R.K. Ramos. Provide one (1) Plaque.
11. Mounting: Blind studs (Concealed Mounting).
12. Text (to be verified at the time of Submittal process):
a. Name of Project.
b. Year of Completion.
c. Name and Positions of Board of Trustees
d. Name and Position of Administrative Staff (minimum 3)
e. Name of Companies of Architect and Construction Manager @ Risk
13. Architect will provide Plaque Layout Drawing for Submittal process.
14. Locate as directed by the Owner and Architect.

2.04 ACCESSORIES

A. Exposed Screws: Chrome plated.

B. Tape Adhesive (Interior Signage): Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with TAS, ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 101400

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments (Floor Mounted; Overhead Braced).

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Concealed steel support members.

B. Section 055000 - Metal Fabrications: Concealed steel support members.

C. Section 061000 - Rough Carpentry: Blocking and supports.

D. Section 102800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.

D. Samples: Submit two samples of partition panels, in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
   2. Scranton Products; Hiny Hiders Partitions: www.scrantonproducts.com/#sle.
   3. Bobrick Washroom Equipment: www.bobrick.com/#sle.
   4. Substitutions: Section 016000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet & Shower Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE); floor-mounted headrail-braced. Heavy duty vandal resistant.
   1. Color and Texture: to be selected from Manufacturer's full line of colors.
   2. Doors:
      a. Thickness: 1 inch.
      b. Width: 24 inch standard width (not ADA) - out-swinging
      c. Width for Handicapped Use: 36 inch, out-swinging.
      d. Height: 55 inch.
   3. Panels:
      a. Thickness: 1 inch.
      b. Height: 55 inch.
      c. Depth: As indicated on drawings.
   4. Pilasters:
      a. Thickness: 1 inch.
      b. Width: As required to fit space.
   5. Location: as indicated on floor plans and interior elevations.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Extruded aluminum, anti-grip profile.
   1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Stainless steel; continuous type.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

E. Hinges: Stainless steel; satin finish.
   1. Continuous-type hinge, self closing - Heavy Duty

F. Door Hardware: Stainless steel; satin finish.
   1. Door Latch: Slide type with exterior emergency access feature.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors.

G. Coat Hook with Rubber Bumper: One per compartment, mounted on door @ 48" AFF Max.

H. Heat sink strip: Manufacturer's standard continuous, extruded-aluminum strip, anti-grip profile with clear anodized finish. Fastened and placed on the bottom of doors and panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 1/2 inch to 1 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in full closed position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 102113.19

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SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 102113.19 - Plastic Toilet Compartments.

B. Section 224100 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.

F. ASTM C1036 - Standard Specification for Flat Glass 2021.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bradley Corporation: www.bradleycorp.com/#sle.
   3. Gamco USA: www.gamcousa.com
   4. Bobrick Washroom Equipment, Inc.: www.bobrick.com/#sle..
   5. McKinney/Parker Washroom Accessories Corp.
   6. Substitutions: Section 016000 - Product Requirements.

B. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating.

E. Framed Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503. Reference interor elevations - some areas have full size mirrors (Reference Glass & Glazing) other toilet rooms are to have single framed miror - Reference Interior Elevation Drawings.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, nickel finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 Commercial Toilet Accessories

A. Toilet Paper and Paper Towel Dispenser: Owner Provided - Contractor Installed

B. Soap Dispenser: Owner Provided - Contractor Installed

C. Framed Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: 24" X 48" Framed mirrors; Where Full size mirrors required - to be included in Glazing bid package.
   3. Frame: 1/2" x 1/2" x 3/8" channel shapes, with mitered corners, and tamperproof hanging system; bright polished finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   5. Products:
      a. Bobrick #B165. Provide one (1) Mirror at each handwash area and as indicated on the Drawings.
      b. Substitutions: Section 016000 - Product Requirements.

D. Toilet & Shower Grab Bars: Stainless steel, peened surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/2 inch outside diameter, minimum .04 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Finish: Satin.
      d. Length and Configuration: As indicated on drawings.
      e. Products:
         1) American Specialties, Inc: www.americanspecialties.com/#sle.
         2) Bobrick #6806. Provide at each Handicapped Accessible Toilet and Sower Compartment and as indicated in the Drawings.
         3) Substitutions: Section 016000 - Product Requirements.

E. Robe Hook: Single-prong, concealed attachment.
   1. Material: Stainless steel; bright polished finish.
   2. Products:
      a. Bobrick #671. Provide two(2hooks in each toilet room - locate as directed by the Architect. (total of 28 hooks)
      b. Substitutions: Section 016000 - Product Requirements.

2.05 Commercial Shower and Bath Accessories

A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.
   1. Products:
      a. American Specialties, Inc: www.americanspecialties.com/#sle.

2.06 Utility Room Accessories

A. Combination Utility Shelf/Mop and Broom Holder: 18 gauge (1.2 mm) thick stainless steel, Type 304, with 3/4 inch (19 mm) returned edges, 0.06 inch16 gauge (1.6 mm) steel wall brackets.
   1. Hooks: Four, 0.06 inch12 gauge (2.8 mm) stainless steel rag hooks at shelf front.
   2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   3. Length: 34 inches.
   4. Products:
      a. Bobrick #B239x34. Provide one (1) at each "Janitor" space
      b. Substitutions: 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. See Section 061000 for installation of blocking, reinforcing plates, and concealed anchors in walls.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.
   2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
   3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall - Bracket hung Fire extinguishers. (Provide one in each mezzanine and janitor room)

B. Fire extinguisher cabinets with Fire Extinguisher. (Provide one at each exterior door)

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide current edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Activar Construction Products Group, Inc. - JL Industries; Saturn Extinguisher - Class K Wet Chemical: www.activarcpg.com/#sle.
2. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
3. Larsen's Manufacturing Company: www.larsensmfg.com: MP-10 (Multi-Purpose Dry Chemical); WC-6L (Class K Wet Chemical); www.larsonsmfg.com.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Enameled steel tank, with pressure gauge. - Provide 11 with cabinets specified below, and an additional 4 with wall hung brackets
   1. Stored Pressure Operated: Deep Drawn.
   2. Class: 4A:80B:C type.
   3. Size: 10 pound.
   4. Finish: Baked polyester powder coat, color as selected.
   5. Temperature range: Minus 65 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Semi-recessed type. - Or fully recessed where possible.- Field verify locations
   1. Provide 11 cabinets with their extinguishers as shown on drawings.
   2. Interior nominal dimensions of 9.5 inch wide by 24 inch high by 6 inch deep.
   3. Projected Trim: Returned to wall surface, with 2.5 inch projection.

B. Door: 1/2 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

C. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Fabrication: Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color. Provide Red Lettering "Fire Extinguisher"

G. Finish of Cabinet Interior: White colored enamel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, at in-height as instructed by Architect from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets and on wall brackets.

3.03 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

3.04 MAINTENANCE - SELF-SERVICE FIRE EXTINGUISHERS

A. Monthly Inspections: Inspect self-service fire extinguishers on monthly basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).

B. Annual Inspections: Inspect self-service fire extinguishers on annual basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).

C. Inspection Certification Tag: Provide new tag indicating acceptable condition of fire extinguisher, date of inspection, and name of self-service inspector for each inspection.

END OF SECTION 104400

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SECTION 105113 - METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers - High School Double tier.

B. Metal Lockers - Kitchen Triple Tier.

C. Reference floor plan for wood cubbies - School Specialties

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete base construction.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

C. ASTM F1267 - Standard Specification for Metal, Expanded, Steel 2018.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. Lyon Workspace Products: www.lyonworkspace.com/#sle.
   2. Penco Products, Inc: www.pencoproducts.com/#sle.
   3. Republic Storage Systems Co: www.republicstorage.com/#sle.

2.02 LOCKER APPLICATIONS

A. Student Lockers: Metal lockers, recessed mounted.
1. Width: 15 inches.
2. Depth: 15 inches.
3. Height: 72 inches.
4. Configuration: Two tier.
5. Fittings: Size and configuration as indicated on drawings.
a. Hat shelf.
b. Hooks: One single prong.
6. Ventilation: Louvers at top and bottom of door panel.
7. Locking: Padlock hasps, for padlocks provided by Owner.
8. Lockers will be installed under fur down locations - provide flat top and coordinate with gypsum board fur down.
9. Color: To be selected from manufacturer's full range by Architect.

B. Kitchen: Metal lockers, free-standing with matching closed base.
1. Width: 24 inches.
2. Depth: 15 inches.
3. Height: 24 inches.
4. Configuration: 3-tier.
5. Fittings: Size and configuration as indicated on drawings.
6. Ventilation: Manufacturer's standard louvers in door panel.
7. Locking: Padlock hasps, for padlocks provided by Owner.
8. Provide sloped top.
9. Color: To be selected from manufacturer's full range by Architect.

2.03 METAL LOCKERS

A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.

B. Locker Case Construction:
1. Heavy-Duty, Welded Construction: Made of formed and welded together sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
2) Body and Shelves: 16 gauge, 0.0598 inch.
3) Backs: 18 gauge, 0.0478 inch.
4) Base: 18 gauge, 0.0478 inch.
b. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
1) Door Frame: 16 gauge, 0.0598 inch, minimum.
c. Where ends or sides are exposed, provide flush panel closures.
d. Provide filler strips where indicated or required, securely attached to lockers.

C. Latches and Door Handles: Manufacturer's standard.
1. Latching: Manufacturer's standard for locking arrangement selected.
a. Three-Point Lift Handle Gravity Latch: Pocket-mounted, provide for doors 18 inches or taller.

1) Handle Pocket, Recess: Stainless steel flush-mounted cup recessed into face of door.
2) Rubber bumpers riveted to door stops for silent operation.

D. Cup, Pocket: Manufacturer's standard, with integral pull, and recessed surface punched for installation of lock, latch lift mechanism, and number plate.

E. Hinges: Continuous piano hinge with powder coat finish to match locker color.

F. Sloped Top: 20 gauge, 0.0359 inch, with closed ends.

G. Coat Hooks: Stainless steel or zinc-plated steel.

H. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1 inch high of block font style with ADA designation, in contrasting color.

I. Built-In Lock Boxes: Same material as locker, manufacturer's standard size, with padlock hasps, for padlocks provided by Owner.

J. Locker Groups: Gang lockers in groups of two and assemble in factory for shipment as a single unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION 105113

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SECTION 107313 - AWNINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal CANOPY

1.02 RELATED REQUIREMENTS

A. Section 076100 - Sheet Metal Roofing.

B. Section 076200 - Sheet Metal Flashing and Trim.

C. Section 099113 - Exterior Painting: Paint finish on framing members.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

D. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2019a.

E. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.

G. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications 2021.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Metal Product Data: Product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Selection Samples: Manufacturer's color charts for metal framing and awning panel colors and finishes.

D. Designer's qualification statement.

E. Executed warranty.

F. Specimen warranty.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of Professional Engineer experienced in design of this type of work and licensed in Texas.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide two-year manufacturer warranty. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Canopy:
1. AVAdek Walkway Covers & Canopies: www.avadek.com/#sle.
2. MASA Architectural Canopies: www.architecturalcanopies.com.

2.02 Canopy - General

A. Configuration: As indicated on drawings.

2.03 METAL CANOPIE

A. Description: Flat metal framework with metal covering attached to building exterior over a door or window to protect from sun or rain.

B. Type: Face-mounted.

C. Framework: Aluminum.

1. Type: Extruded Aluminum

2. Size: 8" X .125"

3. Decking: 3" X 6" X .090" Interlocking Extruded Aluminum Flat Soffit Decking

4. Attachment : as required to meet final conditions

5. Fascia: Profile: 8" Industrial

D. Covering Materials:
1. Interlocking extruded aluminum decking modules.

2.04 FABRICATION - FRAMING

A. Fit and shop assemble components in largest practical sizes, for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

C. Drainage system to be open with natural runoff, covered surfaces to direct water to field drilled drain, to coordinate at site.

D. Exposed Fastenings: Unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of framing. Fabricate anchors and related components of same material and finish as framing, except where specifically noted otherwise.

F. Continuously seal joined pieces by intermittent welds and plastic filler.

G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

H. Accurately form components to suit each other and to building structure.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall substrate anchors are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION - FRAMING

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Provide anchors required for connecting framing to structure. Anchor framing to structure.

D. Field weld anchors as indicated on drawings. Grind welds smooth. Touch-up welds with primer.

E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 INSTALLATION - Metal COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal covering panels to metal support members, aligned level and plumb.

C. Install fascia panels, trim, and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.05 TOLERANCES

A. Maximum Misalignment From True Position: 1/4 inch.

END OF SECTION 107313

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foodservice equipment.

B. Connections to utilities.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between equipment and adjacent walls, floors, and ceilings.

B. Section 114001 - Custom Fabricated Foodservice Equipment.

C. Section 233813 - Commercial-Kitchen Hoods: Range and dishwasher hoods for commercial kitchens.

D. Division 26 - Electrical: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. FM (AG) - FM Approval Guide current edition.

E. ITS (DIR) - Directory of Listed Products current edition.

F. NSF 2 - Food Equipment 2021.

G. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.

H. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, and wiring diagrams.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. Operation Data: Provide operating data for the specified equipment.

F. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of standard products of the type specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products clear of floor in a manner to prevent damage.

B. Coordinate size of access and route to place of installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work of this section within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for replacement or repair of scheduled equipment, refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foodservice Equipment:
1. Bunn-O-Matic Corporation: www.bunn.com
2. Everest Refrigeration: www.everestref.com
3. Hoshizaki American Inc: www.hoshizakiamerican.com
4. Hobart Corp: www.hobartcorp.com/#sle.
5. Vulcan Hart Corp: www.vulcanhart.com/#sle.
6. Advance Tabco
7. Duke
8. Eagle Master Shelving
9. Bally box
10. Substitutions: See Section 016000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for utility requirements.

B. Products Requiring Electrical Connection: Listed and classified by FM (AG), ITS (DIR), UL (DIR), or testing agency acceptable to local authorities having jurisdiction as suitable for the purpose specified and indicated.

2.03 EQUIPMENT

A. Equipment Schedule: Refer to schedule at end of this section and on the drawings.
   1. Equipment Eligible for Energy Star Rating: Provide Energy Star Rated equipment
   2. Cooler and Freezer Units: Listed by UL (DIR).
   3. Electrical Wiring and Components and Self-Contained Refrigeration Systems: Comply with UL (DIR) listed product standards.

B. Installation Accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666 Type 304 commercial grade, No. 4 finish.

C. Glass: ASTM C1036 annealed, and laminated, 4 mm thick; exposed edges ground; cut or drilled to receive hardware.

D. Finish Hardware: Manufacturer's standard.

E. Service Outlet Covers and Escutcheons: Stainless Steel.

2.05 FABRICATION

A. Install rubber button feet on bearing surface of any item positioned on a finished surface.

B. Isolate rotating or reciprocating machinery to prevent noise and vibration.

C. Provide indirect drain piping from equipment to terminate over nearest waste receptor.

D. Accommodate site installation of other services or equipment.

E. Welding: use welding rod of same composition as metal being welded.
   1. Welded Butt Joints: Provide full penetration welds for full-joint length. Make joints flat, continuous and homogenous with sheet metal with out relying on straps under seams, fill in with solder, or spot welding.
   2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces

F. Fabricate field assembled equipment prepared for field-joining methods indicated. For metal butt joints, comply with referenced SMACNA standards.

2.06 FINISHES

A. Components: Shop finish.

B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply minimum two coats factory baked epoxy, color as selected.

C. Stainless Steel: No. 4 finish.
   1. Concealed Surfaces # 2B finish - Bright, unpolished
   2. Exposed Surfaces : 4 - Bright Directional polished.
   3. Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary protective covering before shipment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify ventilation outlets, service connections, and supports are correct and in required location.
   1. Examine areas with installer present, for compliance with all requirements for installation tolerances, service utility connections and other conditions that may affect installation and performance of food service equipment.

B. Verify that electric power is available and of the correct characteristics.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

D. Examine roughing-in for piping, mechanical and electrical systems to verify actual locations of connections before installation

3.02 INSTALLATION

A. Install items in accordance with manufacturers' instructions, level and plumb.

B. Insulate to prevent electrolysis between dissimilar metals.

C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements. Provide closed butt and contact joints that do not require a filler. Grind field welds on stainless steel equipment smooth and polish to match adjacent finish.

D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

E. Use anchoring devices appropriate for equipment and expected usage.

F. Provide cutouts in equipment, neatly formed where required to run service lines through equipment to make final connections.

3.03 EXISTING EQUIPMENT

A. Re-used Equipment: Refer to schedule on drawings for re-used equipment when necessary for voluntary value engineering - base bid will be all new equipment

3.04 ADJUSTING

A. Adjust equipment and apparatus to ensure proper working order and conditions.

B. Remove and replace equipment creating excessive noise or vibration.

3.05 CLEANING

A. Remove masking or protective covering from stainless steel and other finished surfaces.

B. Wash and clean equipment.

C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

3.06 CLOSEOUT ACTIVITIES

A. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.
   1. Test each piece of equipment prior to demonstration.
   2. Individual Performing Demonstration: Fully knowledgeable of all operating and service aspects of equipment.

3.07 PROTECTION

A. Remove protective coverings from prefinished work.

B. Protect finished work from damage.

3.08 FOOD SERVICE EQUIPMENT SCHEDULE (Reference Drawing QF101 for Full Schedule & Equipment Plan)

A. **Items #1, #2, #3, #4:** Part of the custom Serving Table; Reference 114001 - Custom Fabricated Food Service Equipment

B. **Item #5: Ice Maker:** Scotsman NS0622A-1
   1. Nugget Style; Prodigy Plus, Standard Soft Nugget Ice, air-cooled; self-contained condenser; production capacity up 644 lb/24 hours; stainless steel finish; provide with "KHOLDER" kit
   2. Ice Bin (Scotsman#B-530P): top-hinge front opening door; 536-lb ice storage capacity; for top-mounted ice maker; vinyl-clad; painted legs; protected with H-GUARD Plus antimicrobial agent
   3. Top Kit: Scotsman #KBT-27 8 inch; ABS
   4. Water Filtration System (Scotsman SSM Plus, Aqua Patrol Plus & Coarse Pre Filter): single configuration SSM1-P, AP1-P, SC10-A
   5. Electrical Characteristics & Accessories: 115v/6/1-ph, 6.0 amps total; Two (2) 6' cords with plugs
   6. Special Warranty: 3 year on entire machine; 3 years on Bin; 5 years on compressor

C. **Item #6: Reach-In Refrigerator :** Everest Refrigeration #ESR1
   1. One Section; 23.0 cubic feet capacity; self-contained top mounted refrigeration; solid hinged self-closing locking doors hinged on right; six (6) (3 standard + 3 additional) epoxy coated wire shelves with height adjustable clips; digital controls with LED display; auto defrost; LED interior lighting; pressure relief port; stainless steel interior & sides; galvanized steel top, bottom, & rear; R290 Hydrocarbon refrigerant; 5" casters (4 total - 2 front locking) ENERGY STAR
   2. Electrical Characteristics & Accessories: 115V/60/1-ph, 3.3 amps; 1/4 HP; Plug Type: NEMA 5-15P
   3. Special Warranty: 3 years on parts & labor; 5 years on Compressor

D. **Item #7: Reach in Freezer** - Everest Refrigeration #ESF1
   1. One Section; 23.0 cubic feet capacity; self-contained top mounted refrigeration; solid hinged self-closing locking doors hinged on right six (6) (3 standard + 3 additional) epoxy coated wire shelves with height adjustable clips; digital controls with LED display; auto defrost; LED interior lighting; pressure relief port; stainless steel interior & sides; galvanized steel top, bottom, & rear; R290 Hydrocarbon refrigerant; 5" casters (4 total - 2 front locking) ENERGY STAR
   2. Electrical Characteristics & Accessories: 115V/60/1-ph, 3.3 amps; 1/4 HP; Plug Type: NEMA 5-15P
   3. Special Warranty: 3 years on parts & labor; 5 years on Compressor

E. **Item #8: Hot Water Dispenser**: Bunn #H5X Elements SST #43600
   1. Bunn 43600.0002 H5X Element Hot Water Dispenser with a 5 gallon capacity, digital thermostat, 212 Deg. F. setting, LED display, programmable, "Energy Saver Mode", Thinsulate tank insulation, stainless steel construction.
   2. Direct water plumbed 1/4" male flare fitting.
   3. Electrical Characteristics & Accessories: 208V / 60 / 1P , 4.05 kw, 19.5 amp

F. **Item #9: Heated Cabinet (Warmer)**: Vulcan #VHFA18
   1. Mobile; non-insulated; capacity - eighteen (18) 18 inch x 26 inch x 1 inch sheet pans or thirty-six (36) 12 inch x 20 inch x 2 1/2 inch steam table pans; fan & air tunnel; fixed tray slides at 3 inches o.c.; glass door; stainless steel construction; 5" casters (2 swivel; 2 rigid with locks)
   2. Electrical Characteristics & Accessories: 120V/60/1-ph, 2.0 kw; 16.7 amp; Two (2) cord with NEMA plug
   3. Special Warranty: 10 year on Heating Element

G. **Item #10: Stainless Steel Work Table**: Advance Tabco MS-243 (Provide 2)
   1. 24 X 36 Stainless Steel Flat Top work table with 6" H. stainless steel legs with adjustable stainless steel feet & bull nose edge
   2. Stainless Steel under shelf with a 3 tier set of stainless steel drawers.

H. **Item #11: Range, four (4) Burner + Griddle**: Vulcan #48S-4B24GN
   1. Restaurant Range; 48 inch length; Stainless Steel front, sides, back riser high shelf with 6 adjustable legs. Extra deep crumb tray with welded corners fully MIG welded frame; CSA Flame; CSA Star; NSF.
   2. Oven: 35,000 BTU/hr. standard bakers depth oven with porcelain oven bottom and door panel 27" d x 26 3/8" w x 14" h. provide with standard 2 racks, 2 rack guide sets and 4 rack positions.
   3. Burner Gas Characteristics & Accessories: four(4) 30,000 BTU burners with lift-off burner heads, Energy saving flash tube open burner ignition system (one pilot for every two burners) shrouded. With Heavy duty cast grates - easy lift off. Grates to have a built in aeration bowl. Natural gas; AllPoints #32-1647 Gas Connector Kit with gas connector hose, quick disconnect, and restraining device
   4. Provide additional accessories - casters for all legs (2 sets of 4)

I. **Item #12: Double Convection Oven, Gas**: Vulcan #VC44GD
   1. Double Deck; solid state controls; electronic spark igniters; 60-minute timer; five (5) nickel-plated racks per oven; 8 inch high legs; stainless steel front, top, & sides; stainless steel door with windows; NSF; CSA Star; CSA Flame; ENERGY STAR
   2. Gas Characteristics & Accessories: Two (2) 50,000 BTU, gas type TBD; gas manifold piping with stacking kit; AllPoints #32-1647 Gas Connector Kit, 3/4 inch x 48 inches long; with gas connector hose, quick disconnect, and restraining device provide additional accessory rack hanger & stainless steel drip pan.
   3. Electrical Characteristics & Accessories: Two (2) 120V/60/1-ph, 15.4 amps total; Two (2) 6' cords with plugs

J. **Item #13: Bakers Table**: Duke 345-55
   1. Bakers Table, with 14 ga Stainless steel top 30" wide top with splash and rear & both sides, 60" long open base with 2 ingredient bins and 2 drawers, centered with stainless legs & cross braces, NSF
   2. Accessories: Provide Overhead shelves, 18 ga. with spice bins
   3. Stainless Steel top - Reinforced with heavy gauge galvanized hat channels, and vinyl cushion for sound deadening
   4. Provide all hardware and items to insure drawers & bins work properly

K. **Item #14: Floor Mixer**: Hobart HL300 Legacy Mixer

1. Planetary mixer; 30 quart; 3-speed geared transmission; #12 attachment hub; digital timer with automatic stop & audible shutoff signal; thermal overload protection; Provide with: "ED" dough hook, "D" wire whip, "B" flat beater; stainless steel mixing bowl; safety bowl guard, Bowl Scraper, and Bowl Truck.
2. Electrical Characteristics & Accessories: 3/4 HP; 1200/240V/50/60/3ph; 2.8 amps total; cord with NEMA 5-15P plug
3. Special Warranty: K-12 School extended 2 years on labor, travel & parts;

L. **Item #15: Work Table with Drawers**: Duke 416S-3696-5R
1. Work Table, stainless steel top & riser, 36" wide top with 5" H. riser, 96" long with stainless, Undershelf & posts, 36" high 16/400 stainless steel NSF
2. Provide Pot Rack,703- table mount, 88" W X 24"D X 14"H triple-bar design, constructed of 1/4" X 1 1/2" stainless steel, 1 5/8: tubular supports mounted through Undershelf to floor, including double prong pot hooks. NSF
3. Provide 2 stainless steel drawers (185)

M. **Items #16, #17, #18 - Custom work Tables**: Part of Custom Fabricated Food Service Equipment; Specification Section 114001 (coordinate with Item #19)

N. **Item #18A Waste Disposer**: Hobart FD4-150
1. Coordinate with Items #16 thru #21 Dish Washing table & sink unit combined with dish return. Disposer basic unit 1 1/2 HP, steel housings, with adjustable flange feet.
2. Control Panel Group 5 200-240v/50/3P
3. Disposer Accessories Group D: vinyl silver saver splash guard ring, vacuum breaker, fixed direction water inlet for sink 7" i.d. stainless steel weld-in adapter.

O. **Item #19: Dishwasher (Door Type)**: Hobart AM16T-BASX-2
1. Door type; high temperature sanitizing with built-in 7.1 KW Sense-A-Temp Booster Heater for 70 degree rise; corner design; approximately 60 racks/hour capacity; 27 inch door opening; interchangeable spray arms; vent fan control; door activated start; automatic tank fill; low water heat protection; Rinse Sentry feature; automatic drain valve; top mounted splash proof controls; pressure regulating valve & line strainer; one (1) flat & one (1) peg rack & 1 Sheet pan rack; single point connection; stainless steel construction; 5.4 KW tank heating unit 3HP wash pump; NSF provide optional splash shield for corner installation
2. Electrical Characteristics & Accessories: 208-240V/60/3-ph, 3 amps; Two (2)
3. Coordinate with Items # 16 thru #21

P. **Items #20 & #21 - Custom Sink & Work Tables**: Part of Custom Fabricated Food Service Equipment; Specification Section 114001 (coordinate with Item #19)

Q. **Item #22: Wire Shelving**: Eagle 2448Z
1. Wire Shelf 48" w x 24" d quad truss design, with 4 pairs of split sleeves per shelf with 800 lb capacity Eagle-brite zinc finish NSF
2. Post are stationary 74" h. grooved in 1" increments , include post caps & leveling bolts
3. Reference plans for starter units or add on units insure complete installation

R. **Item #23: Ice Cream Box** - Provided by Owner

S. **Item #24: Milk Box** - Provided by Owner

T. **Item #25: Rolling Cart** - Provided by Owner

U. **Item #26: Wire Shelving Unit - Walk In Refrigerator**: Eagle S4-74-2448VG
1. Wire Shelf 48" w x 24" d quad truss design, with 4 pairs of split sleeves per shelf with 800 lb capacity Valu-Gard green epoxy finish NSF
2. Post are stationary 74" h. grooved in 1" increments , include post caps & leveling bolts
3. Reference plans for quantity of starter units or add on units insure complete installation.

V. **Item #27: Walk- In Freezer Unit** - Job Built Bally or US Cooler
1. Pre-assembled air cooled Freezer Unit 26 ga. stucco embossed aluminum exterior and 22 ga. interior panels with urethane insulation to form a 4" thick panel, 14 gauge galvanized steel floor (4" thick placed in a recessed concrete slab) with 36 X 78 in-fitting door with magnetic gaskets (2) cam action spring loaded self closing hinges, piston action door closers, horizontal cylinder latch and view panel with safety release Mechanism.
2. Provisions for pad locking and inside emergency release; anti-condensate heater cable at door perimeter, Interior vapor proof light and pilot type light switch; flush face dial thermometer, pressure relief port and heavy duty ADA approved threshold.
3. This unit shall be able to be assembled on site or shall be placed on site before all walls surrounding the unit are constructed.
4. Provide trim pieces as necessary to close the sides of the unit against the drywall ceramic tiled walls of the room for a neat appearance and for cleaning;
5. Provide outdoor preassembled remote condensing unit on concrete pad and weather proof housing Coordinate location of exterior unit with mechanical and architect.
6. Coordinate the condensate line from the unit to the janitor sink in the adjacent janitor closet Southeast of the unit.
7. Electrical Characteristics: 208-230V / 60 / 1P RAL: 18.4; MOPD 15 MCA:35, Evaporator: 115/60/1P , Fan 1 amps, 3 HP compressor, Defrost amps: 9.8
8. Room Temperature: -10Deg F.
9. Electrical Characteristics & Accessories: 208V/60/1P 4.05kw, 19.5 amp

W. **Item #28: Walk-In Cooler Unit** - Job Built Bally or US Cooler
1. Pre-assembled air cooled Freezer Unit 26 ga. stucco embossed aluminum exterior and 22 ga. interior panels with urethane insulation to form a 4" thick panel, 14 gauge galvanized steel floor (4" thick placed in a recessed concrete slab) with 36 X 78 in-fitting door with magnetic gaskets (2) cam action spring loaded self closing hinges, piston action door closers, horizontal cylinder latch and view panel with safety release Mechanism
2. Provisions for pad locking and inside emergency release; anti-condensate heater cable at door perimeter, Interior vapor proof light and pilot type light switch; flush face dial thermometer, pressure relief port and heavy duty ADA approved threshold.
3. This unit shall be able to be assembled on site or shall be placed on site before all walls surrounding the unit are constructed.
4. Provide trim pieces as necessary to close the sides of the unit against the drywall ceramic tiled walls of the room for a neat appearance and for cleaning;
5. Provide outdoor preassembled remote condensing unit on concrete pad and weather proof housing Coordinate location of exterior unit with mechanical and architect.
6. Coordinate the condensate line from the unit to the janitor sink in the adjacent janitor closet Southeast of the unit.
7. Electrical Characteristics: 208-230V / 60 / 1P RAL: 6.9; MOPD 15 MCA:15, Evaporator: 115/60/1P Fan .08 amps 1 HP compressor
8. Room Temperature: 35 Deg F.

X. **Item #29: Wire Shelving Space Saving System**: Eagle Master Trak MKU24-Z
1. Overhead track unit for high density storage system; 74" h. posts, and shelving with 5" casters with poly tread, include all necessary parts and hardware. Each mobile unit to have 900 lb capacity with Eagle-brite zinc finish.
2. Overhead track kit, Master Trak overhead track high density system 8' includes all necessary sections of front and rear tracks include all hardware NSF
3. Stationary End / intermediate unit kit Master Trak storage systems includes Wire Shelf 48" w x 24" d quad truss design, with 4 pairs of split sleeves per shelf with 800 lb capacity Valu-Gard green epoxy finish NSF
4. Post are stationary 74" h. grooved in 1" increments , include post caps & leveling bolts
5. Reference plans for quantity of starter units or add on units insure complete installation.

Y. **Item #30: Staff Lockers**: Reference Lockers; Specification Section 105113 Metal Lockers

Z. **Item #31: Hand Wash Sink** - Reference Plumbing Plans and Specifications

AA. **Item #32: Cooking Hood** - Reference Mechanical Plans and Specifications

BB. **Item #33: Wall Mounted Pot Filler at Range** - Reference Plumbing Plans and Specifications

CC. **For All Items:**

1. Refer to Section 260583 for Electrical Connections
2. Motors: NEMA MG1.
3. Controls: Provide control switch or starter on each motor driven appliance or heating element, in accordance withUL (DIR) listed product requirements.
4. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
5. Disconnect Switch: Factory mount disconnect switch {CH#72689}
6. Cord and Plug: Provide unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.
7. Cord and Plug: Provide suitable length of three wire cord with plugs to match building receptacles.
8. Provide internal wiring for equipment, including electrical devices, wiring controls, and switches to a common junction box.
9. Provide lamps for fixtures in equipment.
10. Provide automatic door switches for refrigeration units.
11. Provide equipment with connection terminals, so that connections for services can be made. Where receptacles are specified for custom equipment, supply cut-outs and outlet boxes set in place and accessible for connection to electrical source.

END OF SECTION 114000

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SECTION 114001 - CUSTOM FABRICATED FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom fabricated stainless steel units, including:
   1. Serving counters and casework.
   2. Food preparation tables, sinks, and shelving.
   3. Pot and pan washing sinks.
   4. Dish and tray washing tables, sinks, and shelving.
   5. Pass-through window frames for serving and dish return.

B. Removal from the Site of existing fabricated food service equipment, including but not limited to:
   1. Baker's Table, Clean Dish Tables, Soiled Dish Tables, Pot & Pan Wash, and a Work Table with a Pots & Pan Rack..
   2. The existing Serving Line (Hot Food Unit, Cold Pan Unit, etc.) shall remain and be modified with some new Hot Food Wells and Fill-Faucet.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on use of existing facilities and disruption of operation; equipment to be salvaged or removed for re-installation.

B. Section 079200 - Joint Sealants: Sealing joints between equipment and adjacent walls, floors, and ceilings.

C. Section 114000 - Foodservice Equipment: General requirements covering all food service equipment work; manufactured equipment items.

D. Section 221116 - Domestic Water Piping: Water supply, sanitary drainage, vent piping and specialties

E. Section 221316 - Sanitary Waste and Vent Piping: Water supply, sanitary drainage, vent piping, and specialties.

F. Section 224100 - Plumbing Fixtures: Specialty food service fixtures.

G. Section 221123 - Facility Natural Gas Piping: Natural gas piping and specialties.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

D. NSF 2 - Food Equipment 2021.

E. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each manufactured product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Configuration, sizes, materials, finishes, locations, utility connections and locations.

C. Shop Drawings: Submit floor plans, elevations, cross-sections, and construction details for fabricated units specified, including:
1. Layout and anchorage of equipment and accessories, including clearances for maintenance and operation and required electrical or plumbing connections.
2. Size, type, and location of equipment drain lines and floor drains.
3. Special conditions, including required slab depressions, cores, wall openings, blockouts, ceiling pockets, access panels, and above ceiling hanger assemblies.
4. Wiring, piping, and schematic diagrams.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

G. Operation and Maintenance Data: Provide maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides; include instructions for maintenance of stainless steel fabrications and components and simplified diagrams for equipment as installed.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual locations of utility connections.

1.05 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of commercial food services equipment with minimum three years documented experience and NSF certified for type of equipment specified.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS A5.8M/A5.8, AWS D1.6/D1.6M, and no more than 12 months before start of scheduled welding work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver fixed equipment that is not to be integrated into structure until after completion of finished ceilings, floor and walls, painting, and lighting.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Tape fiberboard or plywood to surfaces as required by equipment shape and installation access requirements.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

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

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Custom Fabricated Food Service Equipment:
1. Advance Tabco: www.advancetabco.com.
2. Wichita Restaurant Supply: www.wichitasupply.com.
3. Substitutions: See Section 016000 - Product Requirements.

B. Hardware and Fittings:
1. Advance Tabco: www.advancetabco.com.
2. T&S Brass: www.tsbrass.com.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Stainless Steel: 18-8 percent chromium-nickel composition, minimum; alloy Type 302, 304, or 316; No. 4 - Brushed finish on exposed surfaces.
1. Sheets: ASTM A240/A240M or ASTM A666.
2. Tubing: ASTM A269/A269M or ASTM A270/A270M; of true roundness with seams and welds ground smooth.
3. Bars: ASTM A276/A276M.

B. Carbon Steel: Galvanized by hot-dip process; do not use galvanized or carbon steel unless specifically indicated or allowed.
1. Sheets: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
2. Shapes: ASTM A36/A36M free of surface defects; galvanized in accordance with ASTM A123/A123M.

C. Sound Deadening Material: Bituminous paint or other water resistant mastic.

D. Manufactured Components:
1. Finish Hardware: Manufacturer's standard; stainless steel with polished finish.
2. Feet for Legs: Bullet shaped stainless steel; screwed into tubular legs with concealed screw threads; minimum 1 inch vertical adjustment.

E. Bolts, Screws, and Rivets: Stainless steel; do not use on exposed surfaces unless specifically indicated or unavoidable.
   1. Bolt and Screw Caps: Provide lock washer and chromium-plated brass/bronze acorn nut to cap visible or exposed threads on inside of fixtures.

F. Anchoring Devices: Stainless steel, of type appropriate for use; provide seismic anchorage as specified in SMACNA (KVS).

2.03 CUSTOM FABRICATED UNITS - GENERAL REQUIREMENTS

A. See drawings for dimensions and configurations; ensure proper fit by taking field measurements prior to fabrication.

B. Provide fully shop assembled units complying with SMACNA (KVS) and NSF 2 and stainless steel components, unless otherwise indicated.
   1. Where details are referenced as "SMACNA" details, refer to SMACNA (KVS).
   2. Stainless Steel Sheet: For surfaces up to 12 feet in length provide one continuous sheet without joints or welds, including back and end splashes.
   3. Joints: Provide welded joints unless specifically indicated or not possible; do not solder or braze stainless steel; do not use bolts, screws, or other fasteners on work surfaces, food contact surfaces, or wet surfaces.
   4. Drainage of Surfaces: Provide distinct pitch of top surfaces toward waste or drain outlets while maintaining level tops of rolled and marine edges and back and end splashes.
   5. Drainage of Equipment: Provide drain piping as indicated; where compartments or pans are intended to hold liquids or catch drips and no drain piping is indicated, provide drain fitting and gravity draining piping terminating over nearest floor drain.
   6. Where cut-outs are indicated for equipment to be set into countertop, provide cut-out in top and back of case body, maintaining continuous counter front; size to fit equipment with sanitary joint.
   7. Wiring: Concealed in enclosed portions or corner posts.
   8. Shop prepare openings for plumbing fixtures, fittings, and other service components.
   9. Sound Deadening: Apply sound deadening material to accessible internal surfaces of metal work and underside of metal counters and sinks.

C. Sinks: Stainless steel, 14 gauge, 0.0747 inch thickness, minimum; provide integral sinks continuously welded to work surfaces, unless otherwise indicated.
   1. Slope to drain at 1 percent, unless otherwise indicated.
   2. Adjacent Sinks: Provide double wall partitions between sinks.
   3. Fittings: Provide waste and overflow fittings, faucets, baskets, and other plumbing fittings as specified in Section 224000.
   4. Sink Faucet Spout Outlets: 5 inches, minimum, above rim of sink.

D. Counter and Table Tops: Stainless steel, 14 gauge, 0.0747 inch thick, minimum; with underbracing as recommended by , and bullnose edges and 45-degree back and end splashes, unless otherwise indicated.

E. Counter, Table, and Sink Edges: Provide finished edge on all open sides; close open ends down to bottom edge of turn down; if not otherwise indicated provide bullnose edges.
   1. Bullnose Edges: SMACNA Figure 2-3 Detail A; 2 inch turn down at 5/8 inch radius, returned at 60 degree angle to not closer than 3/4 inch to face of cabinet or case.
   2. Raised Roll Edges: 3 inches turn up coved at 1/4 inch radius, 1-1/2 inches wide rim rolled at 180 degrees, turned down 1 inch.
   3. Dish Tables and Counters: Make watertight joint into dishwashing machine.

F. Back and End Splashes: Provide wherever tops abut walls or other vertical surfaces; close open ends from top to bottom of turned down top edge.

1. 45 Degree Back and End Splashes: 6 inches high, coved at 5/8 inch radius, turned back 2 inches at the top at 45 degree angle, turned down 1 inch.
2. Where indicated and where required for concealment of plumbing, make horizontal dimension of back and end splashes at least 2-1/2 inches from face of wall.
3. Wall Clips: 4 inch long 14 gauge, stainless steel "zee" clips; anchored to wall at 36 inches on center.

G. Legs: Stainless steel tubing, 1-5/8 inches outside diameter; fit legs with set-screw fastened sockets and adjustable feet as specified.
1. Legs Over 12 inches Long: 14 gauge, 0.065 inch, minimum, wall thickness.
2. Legs Up To 12 inches Long: 16 gauge, 0.06 inch, minimum, wall thickness.
3. Weld leg sockets to continuous channel or angle or gusset plates; provide stainless steel triangular pad where leg gussets are welded to frame.
4. Unless otherwise indicated provide legs for all units.

H. Shelves: Stainless steel.
1. Undercounter Shelves: 18 gauge, 0.0478 inch thick.
2. Overshelves: 16 gauge, 0.0598 inch thick.
3. Overshelf Supports: Stainless steel tubing extending through table top and shelving, 12 gauge, 0.1046 inch.

I. Pass Through Window Frames: Channel frame of 18 gauge, 0.0478 inch stainless steel.
1. Dish Washing Areas: Align and lap frame with adjacent dish table to provide watertight connection.

J. Sneeze Guards: Fully tempered float glass mounted in stainless steel channel frames; provide adjustable brackets allowing easy loading of food trays.

K. Tray Slides:
1. Construction: Closed, solid stainless steel 14 gauge, 0.0747 inch thick, flat with solid stainless steel, front edge rolled, back edge turned up behind counter top turndown, and ends closed.
2. Support Brackets: Stainless steel.

L. Flatware Dispensers: Removable stainless steel containers sitting on top of counter top.
1. Containers: 3 Cylindrical, perforated; stainless steel, 18 gauge, 0.0478 inch thick.

M. Casework Not Otherwise Specified: Stainless steel, 20 gauge, 0.0359 inch thick.

N. Flashings: Stainless steel, 20 gauge, 0.0359 inch; provide to cover joints between:

2.04 SERVING COUNTERS

A. Serving Counter Height:
1. Non-Self-Service: 34 inch.

B. Student Tray Slide Height: 34 inch.

C. Food Protectors: Glazed sneeze guard with serving shelf mounted on top; entire assembly mounted on countertop.
1. Front: Glazed with air space at top and bottom.
2. Ends: Glazed.
3. Uprights: 1-1/4 inch square stainless steel tubing uprights.
4. Serving Shelf: Stainless steel, 16 gauge, 0.0598 inch, with rolled edges and radiused corners.

D. Hot Serving Sections: Stainless steel, built with top and body as part of serving counter.

1. Removable Pans: 18 gauge, 0.0478 inch stainless steel with welded seams and support flange.
   a. Pan Openings: Die stamped, beaded edges with flange turned down inside.
   b. Number and Sizes of Pans: As indicated on drawings.
   c. Pan Depth: 8 inches, unless otherwise indicated.
2. Wet Electric Compartments (Item #16 - new compartments in existing Hot Serving Sections): Provide standing overflow tube; anti-siphon water inlet; brass drain; and UL-listed. electric immersion heater and thermostat.
   a. Hot Food Wells: APW Wyott #HFW-4D (12 x 20 inches; infinite controls; EZ lock; insulated with drains; stainless steel; aluminum housings
   b. Pan Depth: 9 inches.
   c. Electrical: 208/240V/60/1-phase; 4800/6400 watts; 23.1/26.7 amps
   d. Faucet: T&S Brass #5F-1SLX06 (deck mount; swivel; lever handles; cerama cartridges; laminar flow device; low lead)

2.05 FOOD PREPARATION

A. Refer to Sheet "QL101" of the Drawings

B. Item #1,#2, #3 & #4 Serving Line: Stainless steel table with legs.
   1. Custom serving line
      a. These items are to be a CUSTOM fabricated stainless steel serving line with sections (Reference Drawings) These items below listed are to show what equipment is required in the contentious Fabricated line. It is not the intention of the architect that the line will be made up of individual units fastened together. The serving line s hall have a flat stainless steel tray slide on fixed brackets on the servers side and on the student side. The serving line shall extend on the servers side from the hot food unit all the way to the last flat top unit prior to turning the angle. The serving line on the student side shall extend from the POS all the way around the corner to the start of the hot food unit. The Tray on the student side shall be mounted at 30" max above finished floor and meet Texas Accessibility standard requirements.
      b. The food service equipment supplier / sub contractor shall have the option of fabricating the individual items but all custom fabricated items shall meet the NSF standards and shall be U.L labeled where required.
      c. The sizing of the utilities for the Food Service Equipment specified in this section has been coordinated with the Mechanical, Plumbing and Electrical work being provided. The Food Service Supplier shall coordinate all utility requirements (Water, Sewer or gas lines, connections and sized, Electrical requirements / characteristics etc. of all equipment with the Mechanical, Plumbing and Electrical Sub-Contractors prior to the fabrication or ordering of any equipment that is Substituted for what is specified and Shall be part of this proposal.
      d. Any accessories listed under a particular item shall be provided with each item of that designation that is indicated in the drawings.
      e. Upon the implementation of the contract, the Food Service Equipment sub contractor / supplier shall immediately submit (within 10 days) rough-in Shop Drawings illustrating requirements for all utilities, drains, electrical connections, etc. for coordination with the MEP sub-contractors and approval of the Architect.
   2. Item #1 Custom Flat Top & Cashiers Stand: AT: BCRS-SS
      a. Where items of this designation are indicated, provide products with the following to be built into custom serving line with all of the following items included. Stainless Steel Body, 6" H stainless steel legs, solid tray slide on students side of the stand, with bullet feet instead of casters, locking cash drawer & foot rest.
      b. Provide 1 - T &S Brass "#B-KF" protective flanges in counter for routing of electrical connections to floor box.

c. minimum length 22", minimum width 30" plus tray side, custom fabricated into full serving line.

3. Item #2 Solid - Flat Top Units
   a. Where Items of this designation are indicated provide products complying with the following: to be built into custom serving line items 1 thru 4 with all of the following items. Stainless Steel Body, 6" H stainless steel legs, solid tray slide on students and serving side of the stand, with bullet feet.
   b. Electrical outlet on servers side of unit, provide wit a top mounted cold water outlet with a spray attachment equal to "T & S Brass # B-0101A " spray with flexible stainless steel hose & "B-KF" protective flange. The flexible hose shall be of sufficient length to reach and adequately clean all items from # 1 thru 4.
   c. At corner unit the server side of the unit does not require the tray slide on the angled corner.
   d. Accessories shall include a integral single dish shelf & Glass front sneeze guard that shall run from the start of the hot food unit to the end of the frost top unit, with end closure.
4. Item #3 Frost Top Unit: Atlas Metal # WF-3-RS-RDVE
   a. Where this item is designated, provided the following to be built into the custom serving line items 1 thru 4 with all of the following items. Stainless Steel Body, 6" H stainless steel legs, solid tray slide on students and serving side of the stand, with bullet feet.
   b. The frost top drop in unit shall have self-contained refrigeration 39" W X 19 1/2" D frost top 14/304 stainless steel with on/off switch & Pilot lite 18 ga. galvanized steel outer case 41-3/4 " X 22 1/4" cutout required UL NSF
   c. Accessories: proper ventilation must be provided, Rear drain Valve Extension
   d. Electrical : 120 V / 60 / 1 P , 1/4 HP, 3.4 amp NEMA 5-15 P Standard with Remote on/off switch for counter mounting
   e. Accessories shall include a integral single dish shelf & Glass front sneeze guard that shall run from the start of the hot food unit to the end of the frost top unit, with end closure.
5. Item #4 Hot Food Unit: Duke ADI-5E-SW
   a. where this item is designated provide products complying with the following built into a custom serving line with items 1 thru 4 with all of the following items. Stainless Steel Body, 6" H stainless steel legs, solid tray slide on students and serving side of the stand. Provide with factory assembled 3/4 manifold drains and screens, fill faucet equal to Krowne Standard Single Pantry Faucet 16-116L.
   b. Hot Food Drop-In Unit, Electric with 5 - 12" X 20" hot food wells, with 2 remote control panels
   c. 74 1/4" long, 12 3/4" high stainless steel top & interior liners, steel exterior housing, sealed wells with drains UL EPH classified
   d. PH voltage - verify & coordinate with electrical
   e. DCOPPER-5 drain manifold, copper tube, brass master valve compression fittings factory assembled for 5 well unit
   f. Accessories shall include a integral single dish shelf & Glass front sneeze guard that shall run from the start of the hot food unit to the end of the frost top unit, with end closure.
   g. Accessories shall include: 5- spillage pans, 5- full size stainless steel pans 2 /12" deep and covers, 3- full size stainless steel pans 4" deep and covers, 2- full size stainless steel pans 6" deep and covers, 2- dome covers for full size pans, 2- half-size stainless steel pans 2 1/2" deep and covers, 2- half size stainless pans 4" deep and covers, 2 - half size stainless steel pans 6" deep and covers, 3 - stainless steel insets 6 1/2" diameter - 4 quart capacity and covers with adapter plates 3- 6 1/2" openings; and adaptors for pans less than the whole opening as required.
6. Item #5 - #15 Reference Food Service Equipment Specification Section 114000
7. Item #16 Vegetable Preparation Sink & Table

a. Where item of this designation is indicated provide a work table to include 115" long Advance Tabco # 9-62-36-36RL Regaline sink - 2 24 X 24 compartment sinks with 24" left side drain board and 36" right hand drain board.
b. 1 set of faucet 1/2" holes, 8" o.c. coordinate and reference Plumbing for faucet information
c. Accessories: provide with 10" high stainless steel splash integral with drainboards, slope drainboards to side sink compartments; provide 2 lever handle operated drains and strainers; provide under shelves under each drain board and 2- # 177 stainless steel drawers under each drainboard.
d. Overshelf: Advance Tabco #OTS-12-60R (non-adjustable; at rear of table); 12 inches wide; Full length of top, 14 inches above top surface.

8. Items #17- #21 Make up the Dish Wash area, for components 18A & 19 Reference Specification Section 114000 for individual items that will be incorporated into this complete product.
   a. Item #17 Clean Dish Table - Advance Tabco # SS- Custom Fabrication - U shaped
      1) Length: 106 inches X 106 inches X 149 inches
      2) Depth: 30 inches
      3) Height to Top: 36 inches
      4) Drawers: Advance Tabco #SHD-2020-X (20 inches wide x 20 inch deep drawers with a 5 inch deep drawer pan insert; heavy-duty; self-closing): Provide two (2) Drawers. on clean side
      5) Overshelf: Full length of table on both east and west side (not open to cafeteria thru wall side, coordinate with dish washer on west side.
      6) Drainboards: One side (24 inch length).draining to dish washer
      7) Backsplash: {CH#149323} high on all sides against wall, coordinate with thru wall dish return window.
      8) Undershelves: Full length and depth of table; provide at each table.
   b. Item #18 Soiled Dish Sink - Advance Tabco # SS- Custom Fabrication
      1) Coordinate with Dish Washer, Pass thru window, garbage disposal & sink
      2) Length: 106 inches.
      3) Sink Compartment Dimensions: 20 inches minimum width and length; 20 inches deep.
      4) Overshelf: on east side of table .
   c. Item #18A & #19 Reference Specification 114000 for equipment
   d. Item #19A Dish Washer Hood - Reference Mechanical Specifications & Drawings
   e. Item #20 & #21 Pot and Pan Washing / Soiled Dish Table: table with integral sinks and drainboards.
      1) Table: Wichita Restaurant Supply Custom Fabrication
      2) Length: 87 inches.
      3) Depth: 30 inches.
      4) Height to Top: 36 inches.
      5) Number of Sink Compartments: 3 total sinks - 2 at 28 X 20 and one centered at 20 X 20
      6) Sink Depth: 24 inches deep.
      7) Sink False Bottoms: Perforated stainless steel, 14 gauge, 0.0747 inch thick.
      8) Drainboards: Both sides.
      9) Backsplash: 10 inches high.
      10) Overshelf: Full length of table .
      11) Mixing Faucet: T&S Brass #B-0231 (wall-mounted; 12 inch swing nozzle; lever handles; quarter-turn Eterna cartridges; low lead)
      12) Pre-Rinse Unit: T&S Brass #B-0133 (wall-mounted mixing faucet; lever handles; quarter-turn Eterna cartridges with spring checks; 18: easy install riser; 44 inch flexible stainless steel hose with heat-resistant gray handle & hold down ring; 1.15 GPM spray valve; finger hook;)

13) Waste Drain Valve: T&S Brass #B-3950-SB (3 1/2inch sink hole; short twist handle; removable strainer basket)

f. Item #22 Shelving - Reference Specification Section 114000 Equipment
g. Item #23, #24, #25 - By Owner
h. Item #26-#29 Reference Specification Section 114000
i. Item #30 Lockers Reference Specification Section 105113
j. Item #31 Hand Wash sink Reference Plumbing Specifications
k. Item #32 Hood Reference Mechanical Specifications

2.06 DISH AND TRAY WASHING

A. Design dishware washing units to accommodate trays and dish racks of standard dimensions:
1. Dish Racks: 20 inches by 20 inches by 4 inches high.
2. Cafeteria Trays: 14 inch by 18 inch.

B. Pass-Through Window: Stainless steel frame, overhead rolling counter shutter, and dish/tray return shelf of same construction.

2.07 FABRICATION

A. Joints, Bends, and Edges: Make each joint close fitting, especially butt and contact joints.
1. Make brake bends free of open-texture or orange peel appearance.
2. Make sheared edges free of burrs, projections, and fins.
3. Neatly finish mitered and bullnosed corners with under edge of material ground to uniform condition, without overlapping materials or cracks.

B. Welding: Make each welded joint smooth, ductile, and watertight, without gaps, holes, or discoloration or marring of surface adjacent to welds.
1. Welding:
a. Stainless Steel: Comply with AWS D1.6/D1.6M.
2. Use welding processes and filler metal compatible with material being welded. Do not use carbon arc welding on surfaces that will be exposed to view in finished work.
3. Grind exposed welds flush with adjacent material; finish and polish to match adjacent surface.
a. Avoid excessive heating of metal and metal discoloration.
b. When grinding, use iron-free abrasives, wheels, and belts that have not been used on carbon-steel.
c. Remove pits, runs, sputter, cracks, low spots, voids, buckles, and other imperfections.
d. Remove grain of rough grinding by several successively finer polishings until specified finish is attained.
4. When welding sheet, penetrate entire thickness for entire length of joint; make joints flat, continuous and homogeneous with sheet metal without reliance on straps under seams, filling with solder, or spot welding.
5. When stainless steel is joined to dissimilar materials, use stainless steel for fastening devices and welding material.
6. Protection Against Corrosion: Eliminate possibility of corrosion wherever welding occurs on stainless steel, and minimize possibility of carbide precipitation in welding bolts and screws.
7. When welding galvanized steel, thoroughly clean and repair damaged galvanizing and coat welds with polyurethane coating.
8. Where bolts or screws are welded to underside of tops or trim, finish and undepress the exposed side of welds.

9. Coat welds and discolorations that are not exposed to view in finished work with metallic-based paint to prevent the possibility of progressive corrosion of joints, unless welds are ground and polished smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify correct locations of utility connections, floor drains, ventilation connections, and supports.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with fabricator's instructions and recommendations, plumb and level and in proper locations, ready for utility connections.

B. Lay out work in advance to prevent damage to building, piping, wiring, or equipment; cut, fit, and patch where necessary; coordinate work with others.

C. Do not cut or fit units in the field; if adjustments are necessary due to inadequate field measurement prior to fabrication, take unit back to shop and perform modifications there.

D. Do not field weld unless absolutely necessary; weld and grind field joints in accordance with specified fabrication procedures.

E. Securely anchor and attach non-mobile or adjustable-leg equipment to walls, floors, or bases with stainless steel bolts.

3.04 ADJUSTING

A. Adjust new and existing equipment to ensure proper operation.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Demonstrate operation of foodservice equipment and identify potential operational problems.

3.06 CLEANING

A. Remove masking or protective covering from stainless steel and other finished surfaces.

B. Clean equipment to condition suitable for food preparation use.

3.07 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 114001

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SECTION 122113 - HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Window Covering Products 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 061000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics and operating features.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds Without Side Guides:
   1. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

B. Source Limitations: Furnish blinds and associated controls produced by a single manufacturer and obtained from a single supplier.

2.02 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.
1. Width: 2 inch.
2. Thickness: 0.008 inch.
3. Color: As selected by Architect.

D. Slat Support: Woven polypropylene cord, ladder configuration.

E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
1. Color: Same as slats.

F. Bottom Rail: Pre-finished, formed PVC; with end caps.
1. Color: Same as headrail.

G. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.
1. Free end weighted.
2. Color: As selected by Architect.

H. Control Wand: Extruded hollow plastic; hexagonal shape.
1. Non-removable type.
2. Length of window opening height less 3 inch.
3. Color: Clear.

I. Headrail Attachment: Wall brackets.

J. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to cover window frames completely.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 061000.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

3.06 SCHEDULE

A. Horizontal blinds at all aluminum exterior window locations.

B. Horizontal blinds at all office interior window locations

C. Horizontal blinds at Teller exterior windows

D. Blinds are NOT intended to be provided for Main Lobby 134, Entry 102, Vestibule 101 and Entry 103.

END OF SECTION 122113

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SECTION 123553.19 - WOOD LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard and custom wood cabinets and cabinet hardware.

B. Reagent shelving.

C. Tables.

D. Wall shelving.

E. Acid storage cabinets.

F. Solvent storage cabinets.

G. Countertops.

H. Ledges.

I. Laboratory sinks.

J. Pegboards.

K. Laboratory emergency equipment

L. Plumbing fixtures.

M. Service fittings and outlets.

N. Reference QL101 for Additional information, schedule, and quantities on plans

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: Requirements for sustainably harvested wood.

B. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: VOC limitations for adhesives and sealants.

C. Section 079200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

D. Section 123553.13 - Metal Laboratory Casework: Additional requirements.

E. Section 224000 - Plumbing Fixtures for non-laboratory sinks.

F. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ANSI A135.4 - Basic Hardboard 2012 (Reaffirmed 2020).

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

D. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment 2014.

E. ASTM C1036 - Standard Specification for Flat Glass 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

I. AWI (QCP) - Quality Certification Program Current Edition.

J. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

K. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

L. NFPA 30 - Flammable and Combustible Liquids Code 2021, with Amendment (2020).

M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. SEFA 1 - Laboratory Fume Hoods 2010.

O. SEFA 2 - Installations 2010.

P. SEFA 3 - Laboratory Work Surfaces 2010.

Q. SEFA 7 - Laboratory Fixtures 2010.

R. SEFA 8W - Laboratory Grade Wood Casework 2016.

S. SEFA 11 - Liquid Chemical Storage Cabinets 2019.

1.05 SCOPE

A. The project consists of supplying and installing complete science equipment for Gordon ISD. The extent of the wood laboratory casework and fixtures is shown on Sheet “**QL101**” of the drawings.

B. In general, the scope of the work under this section of the specifications is to provide wood laboratory casework, epoxy resin tops, electrical and mechanical devices, and any utility connections or piping not indicated for the General Contractor to provide.
   1. Furnishing, delivering to the building, uncrating, setting in place, leveling, and anchoring all casework, countertops, equipment, and technical products listed in the specifications, equipment schedule or shown on the drawings.
   2. Furnishing and installing filler panels and scribes as required for finished installation.
   3. Furnishing laboratory service fixtures and fittings, as described in the specifications, equipment list or shown on the drawings, that are directly attached to the casework or equipment, complete with tank nipples and lock nuts for mounting on tops or curbs. Installation and final connections will be by other respective trades as part of their work.
   4. Furnishing laboratory sinks and cup sinks, complete with threaded sink outlets, and required overflows, plugs, and strainers as described in the specifications, equipment list or shown on the drawings. Installation and final connections will be by other respective trades as part of their work.
   5. Furnishing electrical service fixtures, as described in the specifications, equipment list or shown on the drawings, that are directly attached to the casework or equipment. Installation and final connections will be by other trades as part of their work.
   6. Removal of all debris, dirt, and rubbish accumulated as a result of installation of this equipment, to an onsite container provided by others.

C. Plans and Specifications are available for review by the Science Equipment Contractor to review work to be performed by the General Contractor or his Subcontractor. The Science Equipment Contractor shall provide all work necessary and/or not provided by the General Contractor in order to have complete and functioning science laboratories.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of casework with related items.
   1. Service Fixtures: Coordinate location and characteristics of service connections.
   2. Equipment and Instruments: Coordinate installation of casework with equipment, scientific instruments, fume hoods, biological safety cabinets, and all specified equipment and cabinetry..

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

C. Keying Conference: Conduct conference prior to ordering keys. Incorporate conference decisions into keying submittal.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Component dimensions, configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware, accessories, and service fittings, if any.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors, reinforcements, and blocking placement dimensions and tolerances, clearances required, and utility locations, if any.

D. Samples For Color Selection: Wood samples, fully finished, for color and species selection. Minimum Sample Size: 2 inches by 3 inches.

E. Manufacturer's installation instructions.

F. Maintenance Data: Manufacturer's recommendations for care and cleaning.

G. Finish touch-up kit for each type and color of materials provided.

1.08 QUALITY ASSURANCE

A. Products of **Sheldon Laboratory Systems, "Classic Oak" Series**, are specified as a basis of design, quality, and layout. The specifications and drawings define and show the **essential minimum requirements**. Where a definite material or manufacturer is specified, it is not the intent to discriminate against any product of another manufacturer. However, it is the intent of this specification to provide for the Owner a quality and educationally functional installation of laboratory equipment and casework, and to exclude inadequate or inferior laboratory equipment and casework.

B. Minimum standards are set forth herein to comply with this intent. Laboratory equipment and casework manufacturer(s)/bidders are cautioned that **ONLY EQUIPMENT MEETING THE STANDARDS SET FORTH IN THE SPECIFICATION WILL BE ACCEPTABLE**.

C. All laboratory casework, including cabinetry, work surfaces, sinks, and accessories, service fixtures and fittings, fume hoods, and technical products should be provided by the Wood Laboratory Casework Manufacturer.

D. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

1.09 DELIVERY, STORAGE, HANDLING, AND SITE CONDITIONS

A. Building: Should be enclosed and weather-tight. HVAC system should be operating and maintaining a temperature range of 65-80 deg F with relative humidity range of 30%-50% to maintain acceptable wood casework moisture content, and to prevent problems such as drawers swelling and doors warping.

B. Additional Conditions:
1. Required grounds/blocking in walls for reinforcement of wall-mounted cabinets must be in place.
2. If floor tile is required under casework, it must be in place.
3. Overhead ductwork, ceiling grid, tile, and light fixtures must be in place.
4. Wet operations shall be complete.
5. Painting shall be complete.
6. Service lines for water, gas, etc. must be flushed clean of dirt and chips, capped and tested for leaks prior to the Plumber's final connections.
7. Electrical service and lighting shall be available in each room where casework will be installed.

C. Field Dimensions: Should be confirmed prior to product fabrication. General Contractor shall provide Guaranteed Dimensions if actual field dimensions are not available in time frame necessary to meet lead times for Laboratory Casework Manufacturer to produce and deliver to jobsite.

D. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

E. Acceptance at Site:

1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

F. Storage:
1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" paragraph of this section.

1.10 WORK BY LABORATORY CONTRACTOR

A. Furnishing, transporting, delivering to the building and to each area or room scheduled for equipment, uncrating, setting in place, leveling, installing filler panels, and anchoring all casework and equipment listed in the specifications or equipment schedule and/or shown on the drawings and/or required for proper performance and compliance with local, state and national codes and regulations.

B. Furnishing and installing plumbing fixtures include grates and tail pieces, and fittings complete with tank nipples, vacuum breakers on all devices, and lock nuts for mounting fixtures and fittings on tops or curbs. Connection will be by other respective trades as a part of their final connections.

C. Furnish electrical service fixtures (including devices and face plates) directly attached to the casework or equipment. Fixture boxes shall be attached or assembled. The installation of device and face plate will be by other respective trades as a part of their final connections.

D. Furnishing and installing sink bowls and cup sinks, complete with all required overflows, plugs and strainers, traps, tail pieces and vacuum breakers on all devices. Sinks shall be supplied, attached, and assembled by Science Equipment contractor. Final connections will be made by the Plumbing Contractor. All piping materials shall be compatible with materials being provided by the Plumbing Contractor as part of final connections. Coordinate all work and supply of compatible materials with the Plumbing Contractor prior to installation of equipment.

E. Furnishing and installing filler panels and scribes as required by the installation or by the Architect for finished installation.

F. Removal of all debris, dirt, and rubbish accumulated as a result of installation of this equipment, leaving premises clean and orderly.

G. Providing all framing and reinforcements of walls, floors, and ceilings necessary to adequately support the equipment, and all bucks and plaster grounds required for proper installation of equipment.

1.11 WORK BY OTHERS

A. Furnishing, installing, and connecting of all service lines, drain lines, piping, and conduit within equipment and fume hoods, in service turrets or tunnels, through, under, or along the backs of working surfaces.

B. Furnishing, installing, and connecting all ductwork from fume hoods to blowers/exhaust fans and from blowers/exhaust fans to final point of discharge to atmosphere. Work shall also include the installation of the unit on the roof, including the roof cap, roof curb, and associated flashing materials with the curb and the blower housing.

C. Furnishing, installing, and connecting of all vents, revents or piping to meet local codes. Providing the painting of piping associated with Shower & Eyewash units.

D. Furnishing and installation of all rigid or flexible conduit, wire, pulling of wire, fittings, special electrical equipment and accessories including receptacles and flush plates sent loose. Wiring and connection of switch to fume hood lights and blower/exhaust fan motors on the roof.

E. Furnishing any miscellaneous materials generally classified as maintenance or supply items.

F. Providing protection and security by General Contractor during and after laboratory equipment installation.

G. Furnishing and installing of the fume hood blower/exhaust fan and associated ductwork from the blower/exhaust fan serving the fume hood unit to a roof cap (refer Mechanical Plans), roof curbs and associated flashings, and blower housings. The Electrical Contractor shall provide all electrical connections required for the blower unit/exhaust fan.

1.12 MOCK-UPS

A. Provide base cabinet, base, upper cabinet, and countertop complete with information on drawers, door, adjustable shelf and countertop.

B. See Section 014000 - Quality Requirements for additional requirements.

1.13 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
1. Ruptured, cracked, or stained finish coating.
2. Discoloration, or lack of finish integrity.
3. Cracking or peeling of finish.
4. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Laboratory Casework - The products specified are based on Sheldon Laboratory Systems, Crystal Springs, MS and are specified herein as the standard of quality on this project; other manufacturers must prove equivalence.
1. Institutional Casework Inc: www.iciscientific.com/#sle.
2. Kewaunee Scientific Corp: www.kewaunee.com/#sle.

B. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 WOOD LABORATORY CASEWORK

A. Wood Laboratory Casework is part of this Laboratory Casework System.

B. General
1. All casework shall be of modern design and shall be constructed in accordance with the recommended practices of the Scientific Equipment and Furniture Association. First class quality casework shall be established by use of modern machinery, tools, fixtures, and skilled workmanship.
2. The following definitions apply to wood laboratory casework units. Size and type of units is indicated on the drawings or equipment list.

a. EXPOSED SURFACES of casework include exterior surfaces visible after installation when all doors and drawer fronts are closed. Visible surfaces in open cases or behind clear glass doors shall be considered as exposed portions. Back of drawer fronts and panel doors shall be considered as exposed surfaces. Bottoms of wall hung cabinets shall be considered as exposed.
b. SEMI-EXPOSED SURFACES of casework shall include interior surfaces exposed to view only when opaque doors are open.
c. UNEXPOSED SURFACES not visible after installation include back rails, top side rails, stretchers, web frames, blocking, components concealed by drawers, underside of knee spaces and drawer aprons, and tops of 82” high tall and wall hung cabinets.

C. Casework Materials
1. Materials used for construction of cabinets, cases and tables as specified herein shall meet or exceed the minimum standards as described.
a. All exterior surfaces exposed to view after installation, and all cabinet interior surfaces shall be Red Oak with the exception of back panels behind opaque doors which shall be Hardboard, and drawer boxes which shall be Birch.
b. All plywood panels with veneer core, particleboard core, or MDF core shall be CARB Phase 2 Compliant.
c. Exposed solid wood: Plain sawn Red Oak lumber, Grade FAS or better, clear and free of defects. Lumber shall be air dried, then kiln dried, and tempered to a moisture content of 6%-9% before use.
d. Unexposed solid wood: Other hardwoods may be used that are Grade FAS or better, clear and free of defects, and properly dried in same manner as exposed solid wood.
e. Plywood: Hardwood Veneer Core Plywood shall be minimum 3-ply (1/4”), 5-ply (1/2”), or 7-ply (3/4”) with select Red Oak, Grade A-1, plain sliced, book match, veneer face and back, and shall be compliant with ANSI/HPVA HP-1 2009. All 9-ply (1”) plywood shall be Grade A-1, whole piece, rotary cut, oak veneer face and back. Use of other hardwood face veneer is acceptable in unexposed areas. Combination core with composite cross bands is acceptable in lieu of veneer core.
f. Plywood: Composite Core Plywood for cabinet drawer fronts and doors shall be 3-ply, 3/4” thick select Red Oak, Grade A-1, plain sliced, book match veneer face and back, and shall be compliant with ANSI A208.1-2009 (PBC) or ANSI A208.2-2009 (MDF).
g. Banding: Plywood panels shall be edge banded where specified herein with 3mm solid Oak edge band.
h. Hardboard: Tempered hardboard shall be 1/4" thick. All hardboard shall be composed of wood fibers and resinous binder compressed under heat and pressure.
i. Glass: Wall Cabinet framed swinging and framed sliding doors shall have 1/8” float glass. Wall Cabinet and Tall Cabinet frameless sliding doors shall have 1/4” float glass with polished edges. Tall Cabinet framed swinging doors shall have 1/4" float glass.
j. Tempered Glass: Tempered safety glass will be provided ONLY WHEN SPECIFICALLY CALLED FOR on the drawings or equipment list.

D. Fabrication - General
1. The Wood Cabinetry selected for this project shall be as follows.
a. Cabinet Front Style: Classic Series - Red Oak.
b. Cabinet drawer front and panel doors feature a square edge with slight radius, partial overlay style with vertical match grain fronts and Oak edge band.
c. Drawer fronts and panel doors on each cabinet are cut from one (1) Oak composite core plywood panel as a MATCHING FRONT SET.

2. Cabinets, tables, and other units shall be of the size and configuration indicated on the drawings and/or equipment list. Wood cabinetry is bored, doweled, grooved, and rabbeted construction.
3. Base Cabinet Construction:
    a. Cabinet End Panels shall be ¾", Oak veneer core plywood. End panels shall be doweled and flued to top frame members, intermediate rails, and bottoms.
    b. Vertical Partitions are 3/4", Oak veneer core plywood.
    c. Exposed or semi-exposed edges of end panels, partitions, bottom panels, and shelves shall be edged with 3mm solid Oak edge banding.
    d. Two-Piece Top Frame consists of nominal 1" X 3" solid Oak front rail, with back edge grooved to receive cross rails, and similar 1" X 3" solid Oak back rail, both set flush with cabinet ends, doweled and glued into place.
    e. Top Frame Cross Rails are nominal 1" X 2-1/4" solid hardwood fully housed into front and back rails with tongue and groove joints to form a full four-sided top frame. CROSS RAILS ARE ONLY PROVIDED IF SPECIFICALLY CALLED FOR.
    f. Intermediate Rails are provided on all base cabinets between drawer/drawer configurations and drawer/door configurations. Rails are 1" X 3" solid Oak with back grooved to receive lock security panels (when panels are required). Rails shall be set flush with cabinet ends, doweled and glued into place.
    g. Bottom Panel shall be 3/4", Oak veneer core plywood. Panel shall be set flush with cabinet ends, doweled and glued into place.
    h. Back Panel shall be 1/4" thick Oak plywood when cabinet interior is exposed and 1/4" hardboard when cabinet interior is semi-exposed. Backs are recessed into grooved end panels and secured on all four (4) sides.
    i. Recessed Front Toe Rail shall be 4"x 3/4" Oak veneer core plywood.
    j. Cabinet Shelves shall be 1", Oak veneer core plywood. Shelves are adjustable on 32mm centers, supported by four (4) nickel-plated steel pin and socket type shelf clips.
    k. Security Panels are 1/4" thick hardboard. Panel is provided between drawer/drawer and drawer/door base cabinets only when called for, OR WHEN LOCKS ARE SPECIFIED TO BE KEYED DIFFERENT.
4. Wall Cabinet Construction:
    a. Cabinet End Panels shall be 3/4", Oak veneer core plywood. End panels shall be doweled and glued to top and bottom panels.
    b. Vertical Partitions shall be 3/4", Oak veneer core plywood.
    c. Exposed or semi-exposed edges of end panels, top and bottom panels, partitions, and shelves shall be edged with 3mm solid Oak edge banding.
    d. Top and Bottom Panels shall be 1", Oak veneer core plywood. Panels shall be set flush with cabinet ends, doweled and glued into place.
    e. Back Panel shall be 1/4" Oak plywood when cabinet interior is exposed and 1/4" hardboard when interior is semi-exposed. Back panels shall be rabbeted into ends and secured on all (4) sides.
    f. Cabinet Shelves shall be 1", Oak veneer core plywood. Shelves are adjustable on 32mm centers and supported by four (4) nickel-plated steel pin and socket type shelf clips.
    g. Top and Bottom Back Rail shall be 4" x 3/4" hardwood veneer core plywood doweled and glued into end panels, and used for attaching the cabinet to wall.
5. Tall Cabinet Construction:
    a. Cabinet End Panels shall be 3/4", Oak veneer core plywood. End panels shall be doweled and glued to top and bottom panels.
    b. Vertical Partitions shall be 3/4", Oak veneer core plywood.
    c. Exposed edges of end panels, top and bottom panels, partitions, and shelves shall be edged with 3mm solid Oak edge banding.
    d. Cabinet Top Panel shall be 1", Oak veneer core plywood. Panel shall be set flush with cabinet ends, doweled and glued into place.

e. Cabinet Bottom Panel shall be 3/4”, Oak veneer core plywood. Panel shall be set flush with cabinet ends, doweled and glued into place.
f. Top Back Rail and Center Back Rail shall be 3" x 1" solid hardwood doweled and glued into end panels.
g. Bottom Back Rail shall be 4” x 3/4” hardwood veneer core plywood doweled and glued into end panels.
h. Recessed Bottom Front Toe Rail shall be 4” x 3/4” Oak veneer core plywood doweled and glued into end panels.
i. Back Panel shall be 1/4” Oak plywood when cabinet interior is exposed and 1/4” hardboard when interior is semi-exposed. Back panels are recessed into grooved end panels and secured on four (4) sides.
j. Shelves shall be 1”, Oak veneer core plywood with one (1) center fixed shelf and four (4) adjustable shelves that are adjustable on 32mm centers, supported by four (4) nickel-plated steel pin and socket type shelf clips.

6. Drawers and Doors:
   a. Drawer Fronts:
      1) CLASSIC SERIES - Square Edge Partial Overlay Style.
      2) 3/4:” Oak composite core plywood and 3mm solid Oak edge band with a slight radius.
      3) Drawer fronts and panel doors on each canine have vertical match grain cut from one (1) plywood panel as a Matching Front Set.
   b. Drawer Box Body:
      1) Front sides, and back are ½” thick 9-ply Birch plywood.
      2) Dovetail joinery all four (4) corners
      3) ¼” thick white finished hardboard bottom.
      4) Bottom is set in grooves on four (4) sides and hot-melt glued on underside.
      5) Drawer box has clear chemical resistant finish.
      6) Top edge of box is provided with FINISED TOP CAP to conceal edge of veneer core.
   c. Panel Doors – Base Cabinets:
      1) CLASSIC SERIES: Square Edge Partial Overlay Style.
      2) 3/4”, Oak composite core plywood and 3mm solid Oak edge band with a slight radius.
      3) Panel doors and drawer fronts on each cabinet have vertical match grain cut from one (1) plywood panel as a Matching Front Set.
   d. Panel Doors – Wall and Tall Cabinets:
      1) CLASSIC SERIES: Square Edge Partial Overlay Style.
      2) 3/4", Oak composite core plywood and 3mm solid Oak edge band with a slight radius.
   e. Panel doors on each cabinet have vertical match grain cut from one (1) plywood panel as a Matching Front Set.
   f. Framed Glass Doors – Wall and Tall Cabinets:
      1) CLASSIC SERIES: Square Edge Partial Overlay Style.
      2) 3/4" x 3” solid Oak top, bottom, and side rails, doweled and glued together, sanded for smooth fit, and edge detailed with a slight radius.
      3) Tall Cabinet doors shall have a 3/4" x 6” wide solid Oak center rail.

7. Utility Tables:
   a. Tables shall be fully framed with 3/4" x 4” radius edged solid Oak apron rails with diagonal heavy-duty steel corner braces locked into grooves and screwed with four (4) screws to inner face of rails. Intermediate rails shall be solid hardwood.

b. Table legs shall be properly fitted into position and securely fastened to diagonal corner braces with nut, washer and 3-1/2” x 5/16” carriage bolt, completely running through the leg providing a positive system, whereby bolt can be tightened without depending upon screw holding power of the table legs. Legs shall be 2-1/4” square laminated solid Oak, thoroughly glued, and radius edged. Legs shall be equipped with rubber leg shoes, and adjustable nylon glides.
c. Available options, WHEN CALLED FOR, include drawers or book compartments, pedestal legs, leg stretchers, and casters.

E. Wood Laboratory Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base and tall cabinets.
1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, schedule, and with following front-to-back dimensions:
a. Base Cabinets: 22 inches.
b. Tall Cabinets: 22 inches.
c. Upper Cabinets: 16 inches.
3. Construction: Joints doweled, glued and screwed, except drawers may be lock-shoulder jointed; with interior of units smooth and flush; cabinet bottom flush with top of face frame; without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
4. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7, and SEFA 8W, components safely support the following minimum loads:
a. Base Units: 500 pounds per linear foot across the cabinet ends.
b. Suspended Units: 300 pounds static load.
c. Tables: 300 pounds, minimum, on four legs.
d. Drawers: 150 pounds or 125 pounds, minimum.
e. Hanging Wall Cases: 300 pounds.
f. Shelves: 100 pounds, minimum.
5. Glazing: Type and thickness standard with manufacturer.
a. Framed Doors: Float glass, with gaskets and removable stops; minimize rattling and vibration.
6. Fittings and Fixture Locations: Cut and drill counter tops, backs, and other components for service outlets and fixtures.
7. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
8. Removable back panels on base cabinets where required for power or electrical access. Provide partial height back panels at sink cabinets.
9. Removable panels at backs of open spaces between base cabinets and at ends of utility spaces not otherwise enclosed.
a. Cutouts for power, data, and plumbing receptacles where indicated on drawings.
10. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
11. Factory-finish all exposed and semi-exposed surfaces with the same finish.
a. Finish Performance with no visible effect when surface is exposed to:
1) Hot water at temperature between 190 degrees F and 205 degrees F trickled down the test surface at 45 degree angle for 5 minutes.
2) Constant moisture in the form of 2 by 3 by 1 inch thick cellulose sponge kept continually saturated with water and in contact with test surface for 100 hours.
b. Preparation: Wood sanded smooth, free from dust and mill marks.
c. Coating: Clear, superior-quality, chemical-resistant acyclic urethane; applied in accordance with manufacturer instructions, force-dried, sanded and wiped clean.
d. Coats: Multiple coats as required to achieve minimum 1.5 mil dry film thickness.

e. Appearance: Clear satin gloss; not cloudy or muddy.

F. Reagent Shelving and Supports.
1. Shelves: 3/4 inch thick epoxy resin shelves in lengths indicated.
a. Depth: 16 inches.
2. Supports: Manufacturer's standard metal support pedestal assemblies.

G. Acid Storage Cabinets - Reference Equipment Schedule: Construction identical to other cabinets, with following exceptions:
1. Completely lined with corrosion-resistant liner material; stainless steel fasteners for all connections and hardware inside cabinets.
2. Shelves: Removable, same material as cabinet, covered with corrosion-resistant liner.
3. Bottom Pan: Liquid-tight liner covering entire bottom of acid-storage cabinet.

H. Solvent (Flammable and Combustible Liquids) Storage Cabinets: Construction identical to other cabinets, with following exceptions:
1. Construct to NFPA 30 and applicable OSHA requirements.
2. Comply with SEFA 11.
3. Fire Resistance: Maximum internal temperature of 325 degrees F at the center, and 1 inch from top of the cabinet when cabinet is subjected to a ten minute fire test that simulates fire exposure of a standard time-temperature curve specified in ASTM E119.
4. Shelves: Full depth, adjustable.
5. Bottom Pan: 2 inches deep, liquid-tight pan covering entire bottom of cabinet.
6. Cabinet Hardware: UL-listed.
a. Hinges: Full-length stainless steel continuous (piano) hinges.
b. Manual-closing Doors: 180 degree opening. Three-point latch arrangement, self-latching when pushed closed.
c. Door Handles: Manufacturer's standard, with slip-resistant grip.
1) Provide manufacturer's standard cylinder lock and key set.
2) Provide means of installing a padlock.
7. Vents: Provide venting.
a. Tie into building lab exhaust system.
b. Vent Connections: 1-1/2 inch minimum diameter, corrosion-resistant piping having flame spread index of 25 or less when tested in accordance with ASTM E84.
8. Signage: Provide manufacturer's standard signage reading "FLAMMABLE - KEEP FIRE AWAY" or similar message in bright red color.

I. Tables: With standard aprons manufactured of not less than 3/4 by 3 1/2 inch solid lumber, machined to receive corner blocks, and bolted to 2 1/8 by 2 1/8 inch solid hardwood legs. 3/8 inch leveling devices, and slip-on type black PVC shoes.
1. Table Drawers: Where indicated, manufacturer's standard drawers. Single drawer for tables up to 48 inches wide, two drawers for wider tables.

2.03 CABINET HARDWARE

A. Hinges: Institutional type, ground tip, five-knuckle, with pins of not less than .177” in diameter and leaves of not less than .095" thick. Hinges shall be 2-3/4” long wrought steel with chemical resistant epoxy powder coating. Two (2) hinges shall be provided on doors under 36" in height and three (3) hinges for doors 36" and over. Standard color of epoxy powder coat is Black. Chrome color of powder coat is available option.

B. Pulls: Solid metal, wire type, 4" long mounted with two (2) screws fastened from back. Pulls shall have chemical resistant epoxy powder coating to match hinges. Provide two (2) pulls for drawers over 24" wide. Standard color of epoxy powder coat is Black. Chrome color of powder coat is an available option.

C. Drawer Slides: Shall be easily removable with a 100 lb dynamic load rating, and have self-closing, 3/4 extension, epoxy powder coated steel, nylon rollers, bottom mount, positive stop features. File drawers shall have full extension, zinc plated anochrome finish, ball bearing, side mount slides with lever release.

D. Door Catches: Provide two (2), top and bottom, dual, self-aligning magnetic catches on base and wall cabinet doors, and two (2) heavy-duty magnetic catches on tall cabinet doors.

E. Elbow Catches: Brass with latch held by coiled compressing spring. Catch plates of 16-gauge plated steel. Provide on base and wall cabinets with double doors where locks are specified.

F. Spring Actuated Latch: Latch has 4-5/8" bevel slide bolt with 2-1/4 lbs./in. actuating spring. Provide on tall cabinets with double doors where locks are specified.

G. Leg Shoes: Molded vinyl or rubber, black, coved bottom type.

H. Glass: Type I, Class I, float glass.

I. Tote Trays: High impact molded plastic tray with high gloss.

J. Locks: PROVIDED ONLY IF SPECIFICALLY SHOWN ON DRAWINGS, OR INDICATED ON THE EQUIPMENT LIST (**Part 2.9**), or where included in a product catalog number.
   1. Locks are laboratory grade, cylinder cam locks, with 5-disc tumbler mechanism, and a dull chrome-plated face. Tumblers and keys are brass, while plug and cylinder are die cast zinc alloy. Locks are equipped with RemovaCoreTM keying control. With the use of a control key, the key core of the lock assembly can be removed and a new key core inserted, changing the entire locking system.
      a. Keying Option - 1: All locks are keyed alike. Each lock is keyed the same as all other locks, and a single key can operate every lock.
      b. Keying Option - 2: Locks are keyed alike per room, but each room different and master keyed. Each lock in a room can be opened with one (1) key, but each room would have a different key, and all rooms can be opened with a single master key. Provide minimum of two (2) master keys per project.
   2. When locks are shown on drawings or equipment list, and DESIGNATED AS BEING KEYED DIFFERENT, the following will be provided. Locks are keyed different and master keyed. Each lock is keyed different from all other locks. All locks in this group can be opened with one (1) master key. With keyed different locks, security panels are provided between drawers and between drawers and cupboards.

K. Sliding Doors (Frameless Glass - Wall Cabinets and Tall Cabinets): 1/4" thick float glass with polished edges. Doors operate on metal track applied at top and bottom front horizontal rails of cabinet. Doors easily removable for cleaning. Locks, when indicated, shall be showcase type.

L. Sliding Doors (Framed Glass - Wall Cabinets): 1/8” thick float glass. Doors operate in overhead plastic track. Plastic track is applied to bottom and sized to allow cleaning space at each end. Locks, when indicated, shall be plunger bolt type.

2.04 COUNTERTOPS

A. Countertops:
   1. Types: More than one type is required, as specified below. See drawings for location of each type of countertop in compliance with SEFA 3-2010 Laboratory Surface.
   2. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.

a. Epoxy Resin Tops (Shelresin): Shall consist of sheets cast from modified epoxy resin and non-asbestos inert fillers; compounded mixture cured and thermoset specifically from formulation to provide exceptional physical and chemical resistance required in medium to heavy duty laboratory environments.
b. Wall counters shall be monolithic throughout without surface coating application, and shall be flat and 1” thick with 1/8” chamfered exposed edges. Provide drip grooves under all exposed edges. Exposed corners shall be eased slightly for safety. Bond joints of tops and splashes with highly chemical resistant cement with properties and color similar to base material. Standard color is Black.
c. Flat Surface Thickness: 1 inch, nominal.
d. Surface Finish: Smooth, non-glare.
e. Color: Black.
f. Exposed Edge Shape: 1/8 inch bevel chamfer.
g. Drip Edge: Drip groove 1/8 inch wide and deep, located 1/2 inch back from edge on underside of each exposed edge.
h. Back and End Splashes: Same material, same thickness; on sink areas 4" high.
i. Fabricate in accordance with manufacturer's standard requirements.

2.05 SINKS

A. Laboratory sinks.
1. Epoxy Resin Sinks (Shelresin): Shall be one-piece, molded construction. Sinks to be “drop-in” style with inside corners and bottoms coved for easy cleaning. Standard color of sink is Black.
2. Epoxy Resin Troughs (Shelresin): Trough for TEII Student Tables shall be one-piece, molded construction with integral raised service turrets. Trough to have inside corners and bottoms coved for easy cleaning, and shall have molded raised ribs to facilitate glassware drying. Standard color of trough is Black.
3. Sink Outlets: Epoxy Resin Sinks and Troughs and Fiberglass Sinks shall be provided with 1-1/2” dia. X 3” threaded polypropylene sink outlet with locknut, removable disc strainer, and sink stopper
4. General: Manufacturer's adjustable support system for undermount sink installation and Sinks with perimeter lip for drop-in installation.
5. Sink types and sizes are indicated on specifications of each item.

B. Non-laboratory sinks are identified on drawings and are specified in Section 224000.

2.06 PEGBOARDS

A. Epoxy pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable black polypropylene pegs. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inches long drain hose to sink.

2.07 LABORATORY EMERGENCY EQUIPMENT Plumbing Fixtures

A. General: Provide emergency equipment products complying with requirements of ANSI Z358.1.

B. Eyewash/Drench Hose Units: Deck-mounted, dual-purpose units. Designed for use as a fixed eyewash when unit is left in deck flange, and as a drench hose when removed from deck flange - Reference included specification.
1. Construction: Stainless steel.
2. Twin eyewash heads with pop-off dust covers, internal flow control, and filter.
3. Handle: Molded nylon.
4. Squeeze Valve: 1/2 inch forged brass squeeze valve activated by stainless steel lever handle.

5. Hose: 4 foot long, reinforced PVC hose.
6. Sign: Manufacturer's standard ANSI-compliant identification sign.

2.08 SERVICE FITTINGS

A. General: Comply with requirements of SEFA 7.

B. Gas Service Fittings and Fixtures:
1. Laboratory Gas Fitting :
a. Valve: Forged or cast brass body, with polished chrome with clear epoxy coating finish.
b. Control: Ball valve. Provide ball valve with chrome plated ball and PTFE seals. Valve handle shall require no more than 5lbs. of force to operate. Valve shall be factory tested at 125 PSI. Maximum working pressure is 75 PSI.
c. Mounting: Deck turret base.
d. Supply Gas: Natural Gas.
e. Outlet: Manufacturer's standard, with removable serration hose end.
f. Handle: Manufacturer's standard four-arm Handle with color-coded index disc.

C. Water Service Fittings and Fixtures:
1. Water Fitting :
a. Valve: Forged or cast brass body, 180 degree inlet - outlet configuration, with polished chrome finish.
b. Mounting: Deck (horizontal surface) turret base, with escutcheon.
c. Outlet: Manufacturer's standard, with anti-splash serrated hose end.
d. Handle: Manufacturer's standard wrist-blade handle with color-coded index disc.
e. Provide units that comply with SEFA 7 – 2010, Laboratory Service Fittings Recommended Practices, and also complying with ANSI/ASME 112.18.1-2005 and certified by CSA International under CAN/CSA B.125.1-05.
f. Provide units fabricated from cast or forged red brass unless otherwise indicated.
g. Provide fittings complete with threaded mounting shanks, locknuts, and washers. Include necessary flanges, escutcheons, extension rods, etc.
h. Provide units complying with ADA accessible requirements where indicated on the drawings or equipment list. Provide one (1) faucet with 4” wrist blade handles at ADA sinks.
2. Escutcheons: Polished chrome.

D. Electrical Fittings and Fixtures:
1. Electrical Fittings, General: Types indicated, for mounting on laboratory casework, including, as appropriate, grounding screws, and mounting accessories and fasteners.
2. See Section 260533.23 for surface raceway systems.
3. Pedestal Boxes.
a. Finish: Epoxy powder coating, wrinkle black.
4. Recessed Boxes: Plated steel.
5. Electrical Power Fitting :
a. General: 3-wire polarized receptacles meeting requirements of NFPA 70.
b. Mounting: recessed.
c. Receptacles: Quadruplex, 5-20R, GFCI, grounded, 20amp, heavy duty.
d. Voltage: 120 V.
e. Service: Normal power.
f. Receptacle Color: White.
g. See electrical drawings for circuiting.
6. Electrical Switch Fitting Type: [_____]:
a. Switch: Single pole.
b. Switch Color: White

7. Electrical Outlet Covers: Stainless steel.

2.09 MATERIALS

A. Adhesives Used for Assembly: Comply with VOC limitation requirements for adhesives and sealants, see Section 016116.

B. Wood-Based Materials:
1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

C. Exposed Solid Wood: Clear, dry, sound, plain sawn, selected for compatible grain and color, no defects.

D. Exposed Hardwood Plywood: Lumber core; HPVA HP-1 Grade AA, Type I; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

E. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.

F. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

G. Hardboard: ANSI A135.4, Class 1, tempered.

H. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.

I. Glass: Fully tempered float; ASTM C1036, Type 1; ASTM C1048, tempered and complying with ANSI Z97.1; 1/4 inch thick minimum; clear.

J. Phenolic Panels: Monolithic core of phenolic resin reinforced with cellulose fibers and manufactured under high pressure and at high temperatures, with melamine-impregnated decorative surface papers; NEMA LD 3 Compact Laminate, Grade CGS.

K. Sound Deadening Material: Inorganic, for sandwich panel fabrication.

L. Sealant for Use in Casework Installation:
1. Manufacturer's recommended type.

2.10 TECHNICAL PRODUCTS LIST - All items are equal to "Sheldon Laboratory Systems" unless otherwise noted.

A. **Items #1 and #2 - Student Lab Center (Pedestal):** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Student Lab Center: “TEII Lab Center”, **#14041** Student Table: Student Table mounted at standard height except at locations where handicapped accessibility is required (refer to the plan for locations). At handicapped accessible work area location (**Item #2A, #14021**), the Lab Center must be **34"H. maximum** to the top with a **27" minimum** knee clearance. The Unit shall have 141212 TEII Annex Assembly.
b. Unit dimensions: 56” x 56” x 67” + Annex + Filler cabinet at Base cabinet.

c. Work Surface (Top): the top shall be black epoxy resin equal to 1" "**Shelresin**" w/ an integral raised marine edge. Provide a drip groove at the edges of the top. The top is 56" square and 67½" across corner w/ a minimum of 3,020 square inches of work surface. Note: at **Item #1A**, the trough corners are 67½" wide and TAS/ADA corners are 74" wide – provide a minimum of 3,450 square inches of total work area.

d. Sink Trough: the trough shall be a full-length (I.D. 56½"L. x 9"W. x 5¼"D.), one-piece molded epoxy resin w/ integral, raised service turrets on each end, a ribbed bottom, and a center drain. Provide with removable flush Trough Covers.

e. Understructure: the understructure shall be molded one-piece fiberglass reinforced polyester w/ Gelcoat surface w ¾" radius on all exterior corners. Provide internal reinforcing braces and webs. Provide two (2) removable access panels immediately below the combination water/gas fixtures for the service connections.

f. Pedestal Base: the Pedestal Base shall be 10 gauge formed steel, 14¾" square, w ¾" radius on outside corners. Attach to the bottom of the Understructure w four (4) heavy-duty steel angle brackets and bolts that provide both support and height adjustment. Base is attached to the floor w/ four (4) 3/16" welded corner gussets. Provide two (2) removable steel panels secured with sheet metal screws that cover 10" x 14" openings on opposite sides of the Pedestal Base – these openings are provided for access to service piping. When properly bolted to the floor, the base shall support 250 lb. load at the perimeter and not allow undue movement of the work surface.

2. Accessories (at each unit location)

a. Service Fixtures: provide two (2) #**80030** "Unimix" service fixtures per table with check valves and cold water / hot water / gas cock (**#81280**) connections. Provide w/ **#82010T** in-line Vacuum Breakers and Aerators. Note: at **Item #1A**, the service fixtures shall be **#80030-WB-BV**, provided with **#WB** wrist blade handles and two (2) **#81270** gas ball valves w/ brass handles.

b. Sink Outlet: provide with one (1) **#PT05** (1-1/2") sink outlet and stopper.

c. Electrical Receptacles: provide two (2) **#85101-GFI**, 20 amp GFI duplex outlets per student table. Provide complete with back boxes, outlet and stainless steel face plate. Provide cutouts in table and install handy boxes to receive outlet device and face plate. Electrical Contractor shall install devices and face plates and make final electrical connections.

d. Crossbar Assemblies: provide two (2) #**86380** Aluminum Crossbar Assemblies and four (4) **#86320** Mushroom Plate Rod Bases per Student Lab Center. Each Cross Assembly shall consist of: two (2) **#86300** apparatus upright rods, one (1) **#86370** crossbar, and two (2) **#86340** rod connectors.

e. Stools: provide adjustable steel framed stools (23½" to 32" height) equal to "Uniflex" #0802 by ArtcoBell. Provide one (1) stool for each student position, including spaces designated for handicapped accessibility. Stools to have 13¼" diameter anti-static polypropylene seats w/ tamper resistant screws. Color of the frames and seats will be as selected by the Owner & Architect from the manufacturer's full range of standard colors (16 colors). Provide with #2 non-skid glides.

B. **Item #3 - Instructor Desk:** Where items of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Instructor Desk (Handicapped Accessible): **#20674** Desk w one (1) base cabinet and one (1) 4-drawer cabinet.

b. Unit dimensions: 31"W. x 72"L. x 34"H.

c. Work Surface (Top): the top shall be black epoxy resin equal to 1" "**Shelresin**".

d. Sink: the drop-in sink shall be **#A05** (I.D. 14"L. x 10"W. x 5"D.), one-piece molded epoxy resin w/ corner outlet on the left end with hot and cold water.

2. Accessories

a. Service Fixture: provide one (1) #**80020-WB-CV** "Unicast" service fixture with check valves and cold water / gas cock connections. Provide w/ **#82010T** in-line Vacuum Breakers and Aerators. The service fixtures shall be provided with **#WB** wrist blade handles and two (2) **#81270** gas ball valves w/ brass handles.
b. Sink Outlet: provide with one (1) **#PT05** (1-1/2") sink outlet and stopper.
c. Electrical Receptacle: provide one (1) **#85101-GFI**, 20 amp GFI duplex outlet. Provide complete with back box, outlet, and stainless steel face plate. Provide cutout in table and install handy box to receive outlet device and face plate. Electrical Contractor shall install device and face plate and make final electrical connections.
d. Crossbar Assemblies: provide one (1) #**86380** Aluminum Crossbar Assembly and two (2) **#86320** Mushroom Plate Rod Bases per Student Lab Center. The Cross Assembly shall consist of: two (2) **#86300** apparatus upright rods, one (1) **#86370** crossbar, and two (2) **#86340** rod connectors.
e. Stool: provide an adjustable steel framed stool (23½" to 32" height) equal to "Uniflex" #0802 by ArtcoBell. Stool to have 13¼" diameter anti-static polypropylene seat w/ tamper resistant screws. Color of the frame and seat will be as selected by the Owner & Architect from the manufacturer's full range of standard colors (16 colors). Provide with #2 non-skid glides.

C. **Item #4 - Safety Station (Shower & Eye/Face Wash):** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Safety Station w/ Overhead Shower & Eye/Face Wash (Handicapped Accessible): "**Guardian" #GBF-1909** barrier-free Safety Station with overhead Shower and Eye/Face Wash unit. The eye/face wash controls, spray heads, and shower controls shall be located as necessary for use by disabled persons (adult age users) as required by the Texas Accessibility Standards (**TAS**). Provide brackets, anchors, etc. as necessary to securely attach the unit to the wall at a minimum of two (2) locations (top & bottom). Provide w/ **#GC** powder coated finish on galvanized pipe and fittings (color as selected by the Owner and Architect). Also provide w/ a #BC stainless steel cover for the eye/face wash bowl.
b. Work by Others: Provide to the Mechanical / Plumbing Contractor for installation.

D. **Item #5 - Safety Glasses Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Safety Glasses Cabinet (wall mounted): **#31170** safety glasses cabinet - 24 gauge white enameled steel cabinet. The doors shall have interlocked/ tamper resistant latches and lock and be provided w/ two (2) keys. The unit shall be provided with an automatic 5-minute cycle timer, built-in germicidal UV lamp, and pilot light to confirm UV lamp is in use. Unit shall also include eight (8) removable wire racks w/ each rack accommodating up to six (6) pairs of glasses or five (5) pairs of goggles (glasses / goggles provided by the Owner). The cabinet shall be located as necessary for use by disabled persons (Adult age users) as required by the Texas Accessibility Standards (**TAS**).
b. Unit dimensions: 24½"W. x 9½"D. x 32"H.
2. Accessories
a. Lock: Provide with a lock.
b. Electrical: provide with a 7ft. three wire grounded electrical cord.

E. **Item #6– Fire Blanket Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Fire Blanket Cabinet(wall mounted): ***Sellstrom*#S97457** 100% high temperature carbon black fiberglass fire retardant blanket in a heavy duty, steel cabinet (with red enamel finish and white letter). The cabinet shall be located as necessary for use by disabled persons (Adult age users) as required by the Texas Accessibility Standards (**TAS**).
b. Unit dimensions: 60”W. x 72”L (blanket); 15”W. x 5½”D. x 16”H. (cabinet).

F. **Item #7** – **Fume Hood**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Air Foil Type Fume Hood: **#90208ADA** air-foil type fume hood unit, complete with wood base cabinets with doors and viewable, operable lift sash, steel superstructure and a knee space. Base cabinet must be **34"H. maximum** for handicapped accessibility.
b. Unit dimensions: 60”W.
c. Work Surface (Top): the top shall be black epoxy resin equal to 1” “**Shelresin**”.
d. Sink: the drop-in sink shall be **#TS04** (I.D. 5.7”L. x 2.7”W. x 3.7”D.), one-piece molded epoxy resin oval cup sink.
e. Hood: shall include a 45-degree angle around the fascia opening, flush-mount radiused air foil across the bottom, upper front panel with louvered air bypass grille for constant volume with vertical sliding sash, and rear upper and lower fixed exhaust baffle, all resulting in minimized turbulence and increased performance for removal of exhaust fumes, vapors, and particulate matter within the enclosure.
f. Superstructure: Provide full frame construction, 16” and 18” gauge steel, rigid, self-supporting assembly with 5” wide, double walls and front posts. Walls consist of a sheet steel outer shell and a corrosion resistant full inner liner, and houses electrical services and remote operating service fixtures. Access to fixture valves is provided by two removable panels with a PVC gasket. Top of the hood contains a 10” round, 20-gauge stainless steel exhaust duct collar. Hood shall be UL 1805 Classified.
g. Sash frame: Steel frame includes a 16-gauge, 1-1/2” bottom sash rail with a full width pull closing on rubber bumper stops, and 7/32” thick laminated safety glass housed into sash frame and set into PVC glazing channels.
1) Powder-coated sash frame is raised and lowered with a counter balance system consisting of a single weight, 2” pulleys, and cable that prevents sash tilting by means of a shaft driven mechanism. This permits one finger operation at any point along full width of pull. Sash cable is 7 x 7 steel, 1/8” diameter, coated to 5/32” dia.
2) The powder-coated, flush-mount, bottom horizontal air foil shall provide a 1” bypass to ensure a clean sweep of air to minimize eddies along the work surface when sash is in the closed position.
h. Hood Standard Features:
1) Black powder coat finish, white 3/16” Poly Resin liner and baffles, T-8 rapid start fluorescent light fixture with two (2) lamps, 1-1/4” thick, black Shelresin, molded, dished, epoxy resin work surface, base cabinet, knee space frame, and removable access panel.
2) Superstructure shall be pre-wired and pre-piped by manufacturer.
3) Provide a metal enclosure panel (skirt) from top of hood to ceiling. Panel finish shall match the Fume Hood finish.
4) SEFA 1-2010 hood design shall be ADA Compliant with work surface height, knee space clearance, and access to services.
i. Hood Exhaust Ratings:

1) 100 FPM recommended face velocity. 1100 CFM exhaust and .34-inch static pressure. Blower, Exhaust Duct, and Roof-Mounted Exhaust Fan to be furnished and installed by the Mechanical Contractor. Refer to the Mechanical Plans for more information.

j. Source Quality Control Testing of Fume Hoods:
1) Evaluation of a manufacturer's proposed product shall take place in their own test facility with no cost to the Owner. Provide third party, independent test reports to Architect for approval.
2) Fume Hood shall be tested as described in SEFA 1-2010 in accordance with latest edition of ASHRAE 110 method of testing performance of laboratory fume hoods, As Manufactured (AM). Hoods shall achieve a rating of 4.0 AM 0.05 ppm or less.

2. Accessories
a. Service Fixtures: provide one (1) remote control cold water downspout fixture and one (1) remote control gas outlet with TAS/ADA handles and powder coat finish.
b. Electrical Receptacles: provide two (2) **#85101-GFI**, 20 amp GFI duplex outlets. Provide complete with back boxes, outlets, and stainless steel face plates. Electrical Contractor shall make final electrical connections.
c. Electrical Switches: provide one (1) **#85106**, light switch and one (1) **#85106** exhaust blower switch. Provide complete with back boxes, toggle switches, and stainless steel face plates. Electrical Contractor shall make final electrical connections.
d. Air Monitor Alarm: provide a #AFA-500 Air Monitor Alarm.

G. **Item #8 – Microscope Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Microscope Cabinet: **#T358216-270** with hinged glass doors, fixed shelves, dividers, and chrome plated ¼" diameter bent wire to accommodate thirty (30) microscopes.
b. Unit dimensions: 35"W. x 16"D. x 82"H.
2. Accessories (at each unit location)
a. Locking Handle: provide with a 3-point locking handle.

H. **Item #9 – Tote Tray Case**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Tote Tray Case: **#T478222-236** Tote Tray Storage Case with shelves.
b. Unit dimensions: 47"W. x 22"D. x 82"H.
2. Accessories
a. Tote Trays: provide thirty-six (36) **#69000** fabricated heavy duty, molded fiberglass tote trays (O.D. 13¼"W. x 19½"D. x 4½"D.).
b. Locking Handle: provide with a 3-point locking handle.

I. **Item #10 – Flammable Chemical Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Flammable Chemical Storage Cabinet: **#25200** flammable chemical metal storage cabinet, 30 gallon capacity with two (2) adjustable shelves w/ reinforced galvanized steel. The cabinet shall have double-wall construction throughout w/ 1½" insulating air space between the inner and outer walls, hinged doors, 2" deep pan-type bottom, screened flame arrestor vent on each side, threaded to accept 2" standard pipe. Cabinet finish shall be bright, safety yellow and labeled in red "Flammable Liquid—Keep Away Fire" letters. The cabinet shall meet or exceed National Fire Protection Association's Combustible Liquids Code 30 and L.S.H.A. safety requirements.
b. Unit dimensions: 43"W. x 18"D. x 44"H.
c. Venting (Work by Others): venting system shall be provided by the Plumbing Contractor – refer to the Plumbing Plans for more information.

2. Accessories
a. Latching System: provide with a 3-point latching system and built-in lock.

J. **Item #11** – **Acid Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Acid Storage Cabinet (Wood): **#SC8051** acid corrosive storage cabinet with one (1) fixed shelf and a capacity for thirty (30) – 2.5 liter or ninety (90) 500 ml bottles. Cabinet shall be constructed of one-inch (1") thick, high-density, 9-ply, exterior grade plywood finished with multiple coats of epoxy paint. Cabinet bottom to be constructed as a liquid-tight, two-inch (2") trough to contain accidental spills. The Top shall be recessed to include a liquid-tight polypropylene tray w/ a capacity to hold 3 gallons of spilled liquid and can be used as a dispensing area. Interior shall be fully lined with 1/8" thick polypropylene and all screws and fasteners are to be plastic. Cabinet shall have an interlocking door assembly, lock hasps and padlock with two keys. The word "ACID" shall be printed on the cabinet in six-inch (6") red letters. Unit shall be furnished with wooden door handle and four leveling feet. Cabinet shall comply with all O.S.H.A. and National Fire Protection Association standards.
b. Unit dimensions: 31"L. x 20"W. x 36½"H.

K. **Item #12** – **Tall Case Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Tall Case Storage Cabinet (Open Shelving): **#T358222-000** tall case storage cabinet (open shelving) unit with four (4) adjustable shelves and one (1) fixed shelf.
b. Unit dimensions: 35"W. x 22"D. x 82"H.

L. **Item #13 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Base Cabinet: **#B353622-544** base cabinet with eight (8) drawers.
b. Unit dimensions: 35"W. x 22"D. x 36"H.
2. Accessories (at each cabinet location)
a. Top and integral splash (4"H.): top and splash shall be black epoxy resin equal to 1" "**Shelresin**". Provide a drip groove at the edge of the top.

M. **Item #14 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Base Cabinet: **#B353622-533** base cabinet with six (6) drawers.
b. Unit dimensions: 35”W. x 22”D. x 36”H.

2. Accessories (at each cabinet location)
a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

N. **Item #15 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Base Cabinet: **#B353622-410** base cabinet with two (2) drawers and two (2) doors.
b. Unit dimensions: 35”W. x 22”D. x 36”H.
2. Accessories (at each cabinet location)
a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

O. **Item #16 A & B – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Base Cabinet:
1) **16A - #B243622-421** Left base cabinet with four (4) drawers and one (1) door.
2) **16B - #B243622-420** Right base cabinet with four (4) drawers and one (1) door.
b. Unit dimensions: 24”W. x 22”D. x 36”H.
2. Accessories (at each cabinet location)
a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

P. **Item #17** – **Wall Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Wall Cabinet: **#W353016-200** wall cabinet with solid wood doors. Provide with two (2) adjustable shelves.
b. Unit dimensions: 35”W. x 16”D. x 30”H.

Q. **Item #18** – **Wall Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Wall Cabinet: **#W183016-000** wall cabinet with no doors. Provide with two (2) adjustable shelves.
b. Unit dimensions: 18”W. x 16”D. x 30”H.

R. **Item #19** – **Wall Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Wall Cabinet: **#W353016-200** wall cabinet with solid wood doors. Provide with two (2) adjustable shelves.
b. Unit dimensions: 35”W. x 16”D. x 30”H.

S. **Item #20** – **Wall Cabinet**: Where items of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Wall Cabinet: **#W353016-250** wall cabinet with glass doors. Provide with two (2) adjustable shelves.
   b. Unit dimensions: 35”W. x 16”D. x 30”H.

T. **Item #21 – Wall Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Wall Cabinet: **#W243016-150** wall cabinet with glass doors. Provide with two (2) adjustable shelves.
   b. Unit dimensions: 24”W. x 16”D. x 30”H.

U. **Item #22 – First Aid Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. First Aid Cabinet: **#66109** First Aid Cabinet with two (2) adjustable shelves. Doors of white melamine and Red Cross.
   b. Unit dimensions: 35”W. x 12”D. x 30.5”H.

V. **Item #23 – Apron/Smock Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cabinet: **#68330** Storage case with one (1) 24 hook pull out carrier and one (1) fixed shelf.
   b. Unit dimensions: 24”W. x 22”D. x 82”H.

W. **Item #24 – Apron Rail**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Rail: **#73826** Apron Rail, hooks for storage of aprons.
   b. Unit dimensions: 47”L. x 5”H.

X. **Item #25 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B353622-000** base cabinet with no doors (open).
   b. Unit dimensions: 35”W. x 22”D. x 36”H.
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

Y. **Item #26 – Wall Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Wall Cabinet: **#W353016-000** wall cabinet with no doors. Provide with two (2) adjustable shelves.
   b. Unit dimensions: 35”W. x 16”D. x 30”H.

Z. **Item #27 – Open Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Open Storage Cabinet (Open Shelving): **#T358222-000** open storage cabinet (open shelving) unit with four (4) adjustable shelves and one (1) fixed shelf.
   b. Unit dimensions: 35”W. x 22”D. x 82”H.

AA. **Item #28 – Solid Wood Door Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Solid Wood Door Storage Cabinet: **#T358222-200** solid wood storage cabinet unit with two (2) wood doors with four (4) adjustable shelves and one (1) fixed shelf.
   b. Unit dimensions: 35”W. x 22”D. x 82”H.

BB. **Item #29 – Glass Door Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Glass Door Storage Cabinet: **#T358222-250** glass door storage cabinet unit with two (2) glass doors and four (4) adjustable shelves and one (1) fixed shelf.
   b. Unit dimensions: 35”W. x 22”D. x 82”H.

CC. **Item #30 – Skeleton Storage Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Skeleton Storage Cabinet: **#T358216-140** skeleton storage cabinet with framed glass door and pull out carrier for skeleton.
   b. Unit dimensions: 35”W. x 16”D. x 82”H.

DD. **Item #31 – Wall Mounted Drying Rack**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Drying Rack: **#70720** 53 pegs, drying rack, phenolic resin with white pegs 5" long and 5/8" diameter.
   b. Unit dimensions: 32"W. x 30"H.

EE. **Item #32 – Drying Rack**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Drying Rack: **#70720** Black phenolic resin shelf 12" wide mounted above the sink, Shelf is 20" long.

FF. **Item #33 – Storage Room Sink and Base Cabinet**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Sink Base Cabinet with doors, drawers, and "fake" front modesty panel at sink.
   b. Unit dimensions: Total 9'6"W. x 24"D. x 34"H.
2. Accessories
   a. Provide with a resin sink 25" long x 15" wide by 10" deep sloped to a drain in the far back corner. Provide a gooseneck water fixture with cold and hot water fittings. Provide with sink outlet, strainer, stopper, and an inline type vacuum breaker at all water fitting locations.
   b. Top integral splash 4" high on each side and back - provide drip groove at edge.

c. Provide B353616-410 modified to fit 34" sink total ADA height on each side of the sink.

GG. **Item #34 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B243616-400** base cabinet with eight (8) drawers.
   b. Unit dimensions: 24”W. x 22”D. x 33”H. **Cabinet will need to be modified to the 33” height to comply with TAS requirements.**
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

HH. **Item #35 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B352922-200** base cabinet with two (2) solid wood doors, eight (8) drawers.
   b. Unit dimensions: 35”W. x 22”D. x 29”H.
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

II. **Item #36 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B352922-310** base cabinet with two (2) soli wood doors and two (2) drawers.
   b. Unit dimensions: 35”W. x 22”D. x 29”H.
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

JJ. **Item #37 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B352922-522** base cabinet with four (4) drawers.
   b. Unit dimensions: 35”W. x 22”D. x 29”H.
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

KK. **Item #38 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B182922-500** base cabinet with three (3) drawers.
   b. Unit dimensions: 18”W. x 22”D. x 29”H.
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

LL. **Item #39 – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet: **#B352922-321** base cabinet with three (3) drawers and one (1) door.
   b. Unit dimensions: 35”W. x 22”D. x 29”H.
2. Accessories (at each cabinet location)
   a. Top and integral splash (4”H.): top and splash shall be black epoxy resin equal to 1” “**Shelresin**”. Provide a drip groove at the edge of the top.

MM. **Item #40 - Student Desk:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Student Desk:**#U723030** workstation utility table with resin top
   b. Unit dimensions: 72"Long x 30"W. x 30"H.
   c. Work surface (top): The top shall be black epoxy resin equal to "Shelresin".

NN. **Item #41 - Utility Table**: Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Utility Table: A combination custom made of utility tables to create one complete 9' long counter with knee space to allow for open area below the counter.
   b. Unit dimensions: 9' long x 30"H. x 22"D. to match adjacent base cabinets.
   c. Top: Top to be black epoxy resin equal to 1" "Shelresin". Provide a drip groove at the edge.

OO. **Item #42 - ADA Student Desk:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. ADA Student Desk:**#19922** adjustable height student desk
   b. Unit dimensions: 54"Long x 24"W. x 23.5" - 33.5"H.
   c. Work surface (top): The top shall be black epoxy resin equal to "Shelresin".

PP. **Item #43 - Student Desk:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Student Desk:**#U963030** workstation utility table with resin top
   b. Unit dimensions: 96"Long x 30"W. x 30"H.
   c. Work surface (top): The top shall be black epoxy resin equal to "Shelresin".

QQ. **Item #44 A & B – Base Cabinet:** Where items of this designation are indicated, provide products complying with the following:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Base Cabinet:
      1) **16A - #B243622-421** Left base cabinet with four (4) drawers and one (1) door.
      2) **16B - #B243622-420** Right base cabinet with four (4) drawers and one (1) door.
   b. Unit dimensions: 24”W. x 22”D. x 33”H. **Cabinet will need to be modified to the 33” height to comply with TAS requirements.**

2. Accessories (at each cabinet location)
   a. Top and integral splash (4"H.): top and splash shall be black epoxy resin equal to 1" "**Shelresin**". Provide a drip groove at the edge of the top.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Environmental Conditions:
   1. Do not deliver casework until the following conditions have been met:
      a. Building has been enclosed (windows and doors sealed and weather-tight).
      b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
      c. Ceiling, overhead ductwork, piping, and lighting have been installed.
      d. Installation areas do not require further "wet work" construction.

B. Verify adequacy of support framing and anchors.

C. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.

B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

D. Set casework items plumb and square, securely anchored to building structure.
   1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
   2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
      a. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft or more, and/or maximum variation from plumb exceeds 1/4 inch per story.

E. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
   3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
   4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

G. Secure upper and floor cabinets to concealed reinforcement at gypsum board assemblies.

H. Separate dissimilar metals to prevent galvanic action.

I. Service Space Framing: Anchor to floor with two fasteners at each frame. Fasten to wall substrates.

J. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
   1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches on center, and at sides of cabinets with not less than two fasteners per side.

K. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.

L. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

M. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

N. Deliver sinks in properly marked boxes, accompanied with written instructions, for installation by appropriate trade contractor(s).

O. Replace units that are damaged, including those that have damaged finishes.

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.

C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION 123553.19

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SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES (Reference Alternates for Quartz Countertops & Sills)

A. Solid Surface Countertops for architectural cabinet work.

B. Solid Surface Window Sills

C. Solid Surface Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 064100 - Architectural Wood Casework.

B. Section 224100 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. AWI (QCP) - Quality Certification Program Current Edition.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.

F. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material 2013.

G. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.

H. PS 1 - Structural Plywood 2009 (Revised 2019).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation .

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops & Window sills: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
         2) Dupont: www.corian.com/#sle.
         3) Formica Corporation: www.formica.com/#sle.
         4) LG Hausys America, Inc; HI-MACS 12mm: www.lghausysusa.com/#sle.
         5) Meganite, Inc: www.meganite.com/#sle.
         6) Wilsonart: www.wilsonart.com/#sle.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      d. Color and Pattern: As selected by Architect from manufacturer's full line.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; edge profile as indicated on drawings; use marine edge at sinks.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
   6. Skirts: As indicated on drawings.
   7. Fabricate in accordance with manufacturer's standard requirements.

C. Reference Alternates - Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness: 1-1/4 inch, minimum.

2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
   a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
   b. Finish on Exposed Surfaces: Polished.
3. Other Components Thickness: 3/4 inch, minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.02 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

C. Cove Molding for Top of Splashes: Rubber with semi-gloss finish and T-spline to fit between splash and wall; 1/2 inch by 1/2 inch.

D. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 FABRICATION

A. Fabricate tops, splashes and sills in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.
1. Where indicated use rubber cove molding.
2. Where applied cove molding is not indicated use specified sealant.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8" in 8 feet maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 123600

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.

B. Pre-finished metal roof panels, Wall Panels & Soffit Panels

C. Insulation.

D. Flashing, Accessories and Trim.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications.

B. Section 079200 - Joint Sealants: Sealing joints between accessory components and wall system.

1.03 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings 2016 (Revised 2021).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

G. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2019.

H. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel 2021, with Editorial Revision.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

J. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

L. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings 2016.

M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

O. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

P. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.

Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

R. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

T. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.

U. MBMA (MBSM) - Metal Building Systems Manual 2019.

V. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

W. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature of Professional Structural Engineer licensed in the State of Texas. Provide Information of Building - Use category, indicating category of building use and its importance factors.

D. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.

E. Designer Qualification Statement.

F. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
   1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.

G. Erector's Qualification Statement.

H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in Texas.
   2. Comply with applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 360, MBMA (MBSM), and AWS D1.1 and D1.3.

C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Member of MBMA.

D. Erector Qualifications: Company specializing in performing the work of this section approved by manufacturer.

E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights. Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

C. Special Warranty on Panels: Written Warranty, executed by Manufacturer agreeing to repair or replace roof and wall panels that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: three (3) years from date of Substantial Completion.

D. Special Warranty on Panel Finishes: Written warranty, signed by manufacturer agreeing to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
   1. Warranty Period: Twenty (20) years from date of Substantial Completion.

E. Special Warranty on Standing-Seam Roof Panel (Weathertightness): Written warranty, signed by manufacturer agreeing to repair finish or replace standing-seam roof panel assemblies that fail to remain weathertight within specified warranty period.
   1. Warranty Period: Twenty (20) years from date of Substantial Completion.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver components, sheets, panels and other manufactured items so as not to be damaged or deformed. Package roof and wall panels for protection during transportation and handling.

B. Handling: unload, store and erect roof and wall panels to prevent bending, warping, twisting and surface damage.

C. Stack materials on platforms or pallets, covered wit tarpaulins or other suitable weather tight and ventilated covering. Store roof and wall panels to ensure dryness. Don not store panels in contact with other materials that might cause staining, denting or other surface damage.

D. Protect insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment
   2. Protect against ignition at all times. Do not deliver insulation materials to project site before installation time.
   3. Complete installation and concealment of materials as rapidly as possible in each area of construction

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Buildings Systems: Varco - VP Building Systems is specified as the standard of quality. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work are the following:
   1. Butler Manufacturing Company: www.butlermfg.com/#sle.
   2. Nucor Building Systems: www.nucorbuildingsystems.com/#sle.
   3. VP Buildings: www.vp.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.
   5. Installation must be provided by the MBM Manufacturer certified and approved installer. No third party installer will be approved. The installation is to be completed as a package with the MBM Representative, and is to have a minimum of 5 years of experience with the MBM provider.

2.02 ASSEMBLIES

A. Tapered beam - rafter, with straight columns up to 15' AFF no tapered columns below that height. - maximum 15" column depth at Main new High School building. Elementary Canopy is to have 12" maximum depth straight columns. - Gray primer is to be provided.

B. Bay Spacing: as indicated on the drawings.

C. Primary Framing: Rigid frame of rafter beams and columns and wind bracing.

D. Secondary Framing: Purlins, and other items detailed at 24" o.c. for masonry sheathing backing.

E. Wall System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, and accessory components.

F. Roof System: Preformed ribbed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly and insulation, and accessory components. Fabricate from metallic-coated steel sheets pre-painted with coil coating, factory formed to provide 24-inch coverage, with 3-inch high (including seam), raised trapezoidal major ribs at panel edges, and intermediate stiffening ribs symmetrically spaced between major ribs for full length of panel. Comply with the following:
   1. Material: Steel.
   2. Yield Strength: 50 ksi.
   3. Metal Thickness: 24 gauge.

4. Joint Type: SSR Snap-Together type and field seamed with electric seamer. Seams shall be mechanically seamed to a full 360 degree "Pittsburgh" type seam.
5. Clip System: Floating to accommodate thermal movement and thermal blocks.
6. Roof Slope: 3 inches in 12 inches.
7. Color: As selected from Manufacturer's standard line of colors.

2.03 PERFORMANCE REQUIREMENTS

A. Installed Thermal Resistance of Wall System: R-value of 13, 4" thickness. Provide vapor-retarder facing composed of polypropylene-faced, scrim-reinforced foil, with permeance of not greater than 0.02 perm.

B. Installed Thermal Resistance of Roof System: R-value of 35, 8" thickness (R-25) plus 3" thickness (unfaced, R-10). Provide vapor-retarder facing composed of polypropylene-faced, scrim-reinforced foil, with permeance of not greater than 0.02 perm, strapped at maximum of 48" o.c.

C. Design structural members to withstand 20 psf live load, 10 psf nominal snow load, and 110 mph wind loads. Also refer to the Structural Drawings for additional information.

D. Design structural members to withstand 120 mph wind uplift in accordance with UL 580.

E. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection as indicated in the Structural Drawings.

F. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

G. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to typical temperature ranges.

2.04 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A36/A36M.

B. Structural Tubing: ASTM A500/A500M Grade B cold-formed.

C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.

D. Anchor Bolts: ASTM A307, Grade A, with no preference for protective coatings.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.

F. Welding Materials: Perform in accordance with AWS D1.1/D1.1M.

G. Primer: SSPC-Paint 20 zinc rich.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
1. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.05 MATERIALS - WALLS AND ROOF

A. Steel Sheet: ASTM A792/A792M aluminum-zinc alloy coated to AZ50/AZM150.

B. Insulation: Blanket - Batt glass fiber type, faced with reinforced white vinyl, ASTM E84 Class A, flame spread index of 25 or less where exposed, friction fit, 3", 4", or 8" inches thickness.

C. Install Insulation concurrently with panel installation, according to manufacturers written instruction and as follows: set vapor retarder faced units with vapor retarded to warm side of construction, Do not obstruct ventilation spaces. Tape joints and ruptures in vapor retarder, and seal each contentious area of insulation to surrounding construction to endure air tight installation. Over Purlin with Spacer Block Installation: extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.

D. Provide Metal banding for all insulated roof structure areas, 48" o.c. maximum spacing.

E. Metal Building Type, Factory Applied, Vapor-Barrier Insulation Facings: Water vapor permeance no greater than 0.02 perm when tested in accordance with ASTM E96/E96M; flame spread index of 25 or less, and smoke developed index of 40 or less when tested in accordance with ASTM E84.
   1. Manufacturers:
      a. Lamtec Corporation: www.lamtec.com/#sle.
      b. Owens-Corning Fiberglass Corporation: www.owenscorning.com.
      c. CertainTeed: www.certainteed.com.
      d. CGI Silvercote, Inc.

F. Joint Seal Gaskets: Manufacturer's standard type.

G. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.

H. Sealant: Manufacturer's standard type.

I. Sealant: ASTM C920, elastomeric sealant with movement capability of at least plus/minus 50 percent; 100 percent silicone; for exposed applications, match adjacent colors as closely as possible.

J. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Fascias and Infills: Same material and finish as exterior sheets; brake formed to required profiles.

2.06 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.

C. Provide wall opening framing for doors, windows, and other accessory components.

2.07 FABRICATION - WALL , ROOF & SOFFIT LINER PANELS

A. Metal Wall Panel Siding: Minimum 26 gauge metal thickness, Panel Rib profile indicated, lapped edges fitted with continuous gaskets. Pre Finished Kynar 500 Coated Sheet from manufacturer's full range of colors. Provide Sealant Tape with pressure sensitive 100% solid gray polyisobutylene Compound sealant tape with releasing backing. Provide permanently elastic non-sag, not toxic nonstaining tape 1/2" wide and 1/8" thick. Provide Joint Sealant that is a one-part elastomeric polyurethane, polysulfide or silicone-rubber sealant; of the type, grade and class and classification use required to seal joints in panels and remain weather tight and as recommended by the MBM system manufacturer.

B. Roofing: Minimum 24 gauge metal thickness (50 ksi yield strength), VP - SSR Standing Seam snap together profile, male/female (mechanically seamed with a electronic seamer with a full 360 degree Pittsburgh type seam) edges fitted with continuous gaskets. The panels shall be prefinished with a "Kynar" finish. The Ridge Cap assembly shall have double-closures on each side of the ridge.

C. Clips System: Floating to accommodate thermal movement and thermal blocks. Minimum .0625" thick, high movable panel clips designed to withstand negative-load requirements. Thermal spacer Blocks are to be provided so panels attach directly to purlins, provide a 1" thick thermal spacer block fabricated from extruded polystyrene.

D. Panel Closures: Provide closures at eave and ridge, fabricated of the same metal as roof panels.

E. Girts/Purlins: Rolled formed structural shape to receive roofing and liner wall sheets. Depth as required, (8 1/2" minimum design utilized)

F. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners with 24 gauge sheet.

G. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.

H. Exterior Soffit Panels: Soffit Liner Panels: 26 ga. galvanized steel with Kynar finish. Color as selected by Architect from full range of colors.

I. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type. Self-tapping screws, bolts, nuts, self-locking rivets and bolts. Provide fasteners with heads matching color of roof or wall sheet by means of plastic caps or factory applied coating.
   1. Fasteners for Roof Panels: self drilling or self tapping hex-head carbon steel screw with a stainless steel cap or zinc- aluminum alloy head and EPDM or neoprene sealing washer.
   2. Fasteners for Wall Panels: self drilling or self tapping zinc-plated hex head carbon screw with nylon or polypropylene washer.
   3. Fasteners for Flashing and Trim: Blind fasteners or self drilling screws with hex washer head
   4. Blind Fasteners: High- strength aluminum or stainless steel rivets.

2.08 FABRICATION - FLASHING, TRIM, GUTTERS AND DOWNSPOUTS

A. Fabricate of same material and finish as roofing metal.

B. Provide Flashing and Trim as required to seal against weather and to provide a finished appearance. Locations include, but are not limited to: eaves, rakes, corners, base, framed openings, ridges, fasciae, and fillers. Trim at openings shall be at head, jamb and sill of openings.

C. Form gutters and downspouts of northern-type profile and size to collect and remove water. Fabricate with connection pieces. Match profile of gable trim, complete with end pieces, outlet tubes and other special pieces as required. Fabricate in minimum 96" long sections, sized according to SMACNA's Architectural Sheet Metal Manual. Furnish gutter supports spaces 24" o.c. max. Provide wire ball strainers at outlets. Color selected by Architect.

D. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.

E. Fabricate support straps for gutters of same material and finish as gutter metal, color as selected. Provide straps spaced at 24" o.c.

F. Fabricate straps for downspouts of same material and finish as downspout metal, color as selected. Provide downspouts that are 4" deep x 6" wide minimum and are strapped to the wall face a minimum of 10' increments. There shall be no less than three (3) straps per downspout - at the top, bottom, and center span. Provide elbow at base of downspout to direct water away from building or tie into underground drainage system - reference civil drawings.

G. Roof or Wall Pipe Flashing: Provide Premolded EPDM pipe color with flexible aluminum ring bonded to base equal to DEK-Tite and installed by the MBM Building installer. Any location allowing cutting a portion of the rib, or close enough to the rib to require Deck-Tite to be installed over the rib will be rejected and a new panel must replace the damaged panel. Coordinate roof panel penetrations to penetrate in the flat portion of the panel.

H. Flashing: comply with manufacturer's written installation instruction. Provide for thermal expansion of metal units; conceal fasteners where possible and set units true to line and level as indicated. Install work with laps, joints and seams that will be permanently water tight and weather resistant. Install exposed flashing and trim that is without excessive oil canning, buckling and tool marks and 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.

I. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed in 24" of corner intersections. Where lapped or Bayonet type expansion provisions can not be used or would not be sufficient weather resistant and water proofing, form expansion joints of intermeshing hooked flanges, not less than 1" deep filled with mastic sealant - concealed within joints.

2.09 FINISHES

A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Erect metal building system according to manufacturer's written instruction and erection drawings by a certified manufacturer installer. No third party installer will be approved.

C. Baseplates and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces before setting base plates and bearing plates. Clean bottom surface of base plate and bearing plates.
   1. Set baseplate and bearing plate for structural members on wedges, shims or setting nuts.
   2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of baseplate or bearing plate before packing with grout.
   3. Pack grout solidly between bearing surface and plates so no voids remain. Finish exposed surfaces, protect installed materials and allow to cure - comply with manufacturer's written instructions for Proprietary grout materials.

D. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

E. Set column base plates with non-shrink grout to achieve full plate bearing.

F. Do not field cut or alter structural members without approval.

G. After erection, prime welds, abrasions, and surfaces not shop primed with gray primer

3.03 ERECTION - ROOF PANELS & WALL PANELS:

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface. Field cutting by torch is not permitted.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.

E. Use concealed fasteners.

F. Install insulation and vapor retarder utilizing the steel purlins with spacer blocks for attachment. Provide metal banding strapping for insulated areas.

G. Install sealant and gaskets, providing weather tight installation.

H. Flange and Sag Bracing: Minimum 1 5/8" x 1 5/8" structural steel angles with a minimum thickness of .0598" to stiffen primary frame flanges.

I. Base or Sill Angles: Minimum 3" x 2" x .0747 zinc coated galvanized steel sheet

J. Purlin and Girt Clips: Minimum .0747" thick zinc coated galvanized steel sheet

K. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum .0747" thick zinc-coated galvanized steel sheet.

L. Framing for Openings: Channel Shapes Fabricated from minimum .0598" thick cold-formed structural steel sheet or structural -steel shapes. Frame head and jamb of door openings, and head, jamb and sill of other openings.

M. Miscellaneous Structural Members: Including Canopy Overhang Beams Manufacturer's standard sections fabricated from cold-formed, structural steel sheet; built up steel plates, or zinc-coated galvanized steel sheet; designed to withstand required loads.

N. Bracing:
1. Rods: ASTM rated Grade 50; 1/2" diameter steel threaded full length or treaded a minimum of 12" at each end.
2. Cable: ASTM A475 1/4" 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 load.
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: Rods or cable may be used int eh plane of roof, but no rods or cables in the walls - Provide Portal frames at the walls.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Slope gutters minimum 1/8 inch/ft.

C. Connect downspouts to underground storm sewer system. Refer to the Civil Drawings for more information.

3.05 EXECUTION & INSTALLATION - ACCESSORY COMPONENTS IN WALL SYSTEM

A. Install door frames, doors, overhead doors, and windows and glass in accordance with manufacturer's instructions.

B. Touchup Painting: Immediately after erection, clean, prepare and prime or re-prime welds, bolted connections and abraded surfaces of primed painted primary and secondary framing, accessories and bearing plates. Apply compatible primer of same type as shop primer used on adjacent surfaces.

C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to manufacturers written instructions.

D. Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surface as recommended by panel manufacturer and maintain in a clean condition during construction. Replace panels that have been damaged or deteriorated beyond successful repair by finish touch up or similar minor repair procedures.

3.06 TOLERANCES

A. Framing Members: comply with erection tolerance limits of AISC S303, "Code of Standard Practice for Steel Buildings and Bridges".

B. Roof Panels: shim and align 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 face and alignment of matching profiles.

END OF SECTION 133419

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SECTION 210510 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Fire-suppression equipment and piping demolition.
7. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Concrete bases.
10. Supports and anchorages.

1.3 GENERAL REQUIREMENTS

A. In general, the lines to be installed by the various trades under these specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of various lines and ducts and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.

B. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.

C. The plans do not give exact details as to elevations of lines, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to provide proper grading of lines, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.

D. The plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections. Minor relocations necessitated by the conditions at the

site or as directed by the Architect shall be made without any additional cost accruing to the Owner.

E. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

F. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

G. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment which any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

H. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.

I. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:

1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
3. Large ducts and pipes with critical clearances.
4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.

J. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.

K. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.

L. Each bidder shall examine the plans and specifications for the General Construction. If these documents show any item requiring work under Division 21 and that work is not indicated on the respective "FP" drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Plans in accordance with the specifications.

M. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.

N. The accompanying plans do not indicate completely the existing installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.4 SUBMITTALS

A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.

B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.

C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.

D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.

E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.5 PERMITS, FEES, ETC.

A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering,

connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.6 LAWS, CODES, AND ORDINANCES

A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.7 TESTING

A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.8 COORDINATION OF TRADES

A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 21 which require electrical connections shall be coordinated with Division 26 for:
1. Voltage
2. Phase
3. Ampacity
4. No. and size of wires
5. Wiring diagrams
6. Starter size, details and location
7. Control devices and details

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

C. Items furnished under various sections which require plumbing connections shall be coordinated for services, pressure, size and location of connections, type of fuel, clearances for service, auxiliary devices required, etc.

D. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.

E. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.

F. All items specified under Division 21 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.

G. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

H. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

I. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified by Architect.

1.9 QUALITY ASSURANCE

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

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

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

1.10 SUBSTITUTIONS

A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.

B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.

C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.11 INSTALLATION DRAWINGS

A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.

B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.13 OPERATING INSTRUCTIONS

A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.14 OPERATING MANUALS

A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.

B. Manuals shall contain the following data:

1. Catalogue data of all equipment.
2. Shop drawings of all equipment.
3. Temperature control drawings (reduced in size)
4. Start-up instructions for major equipment.
5. Trouble shooting procedures for major equipment.
6. Wiring diagrams.
7. Recommended maintenance schedule for equipment.
8. Parts list for all items.
9. Name and address of each vendor.

1.15 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 ESCUTCHEONS

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

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.3 ACCESS DOORS

A. Wherever fire suppression equipment is installed and where future access is required through either walls or ceilings and such cannot be obtained through the removable ceiling or through other means, the Contractor shall provide Milcor Style "M" access doors at least 12 inches by 12 inches in size or larger if required for access. Provide access doors for all valves, etc. Provide Milcor Style "UFR" rated access panels as required for installation in rated construction.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

END OF SECTION 210510

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SECTION 211313 - FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Sprinkler system piping designed to operate at working pressure 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if required.

B. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified person, using performance requirements and design criteria indicated.

1. Fire-hydrant flow tests not available during production of construction documents. It is the responsibility of the Contractor to acquire flow test records for project prior to bid.

The Contractor shall include all components required for fire protection system to properly operate with flow data found.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Ha□ard Classifications:

a. Automobile Parking Areas: Ordinary Ha□ard, Group 1.
b. Building Service Areas: Ordinary Ha□ard, Group 1.
c. Electrical Equipment Rooms: Ordinary Ha□ard, Group 1.
d. General Storage Areas: Ordinary Ha□ard, Group 1.
e. Mechanical Equipment Rooms: Ordinary Ha□ard, Group 1.
f. Office and Public Areas: Light Ha□ard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Ha□ard Occupancy: 0.10 gpm over 1500-sq. ft. area.
b. Ordinary-Ha□ard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler: Per UL listing.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified Installer.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Fire-hydrant flow test report.

F. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional services needed to assume responsibility. Base calculations on results of fire-hydrant flow test.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 PROJECT CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Architect's written permission.

1.9 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe si□es.

2.2 STEEL PIPE AND FITTINGS

A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

C. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

D. Schedule 40, Galvani□ed-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

E. Galvani□ed-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

F. Galvani□ed, Steel Couplings: ASTM A 865, threaded.

G. -Joint, Steel-Pipe Appurtenances:

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

   a. Anvil International, Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bron□e Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

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

a. Anvil International, Inc.
b. Clow Valve Company; a division of McWane, Inc.
c. Fire-End & Croker Corporation.
d. NIBCO INC.
e. Potter Roemer.
f. Reliable Automatic Sprinkler Co., Inc.
g. Tyco Fire & Building Products LP.
h. Victaulic Company.

C. Ball Valves:

1. Standard: UL 1091 except with ball instead of disc.
2. Valves NPS 1-1/2 and Smaller: Bron□e body with threaded ends.
3. Valves NPS 2 and NPS 2-1/2: Bron□e body with threaded ends or ductile-iron body with grooved ends.
4. Valves NPS 3: Ductile-iron body with grooved ends.

D. Iron Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Style: Lug or wafer.
5. End Connections: Grooved.

E. Check Valves:

1. Standard: UL 312.
2. Pressure Rating: 250 psig minimum.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

F. Iron OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast or ductile iron.
4. End Connections: Flanged or grooved.

G. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bron□e.

c. End Connections: Threaded.

4. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

H. NRS Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast iron with indicator post flange.
4. Stem: Nonrising.
5. End Connections: Flanged or grooved.

I. Indicator Posts:

1. Standard: UL 789.
2. Type: Horizontal for wall mounting.
3. Body Material: Cast iron with extension rod and locking device.
4. Operation: Wrench.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.

3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

D. Dry-Pipe Valves:

1. Standard: UL 260
2. Design: Differential-pressure type.
3. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
4. Air-Pressure Maintenance Device:

   a. Standard: UL 260.
   b. Type: Automatic device to maintain minimum air pressure in piping.
   c. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

5. Air Compressor:

   a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   b. Motor Horsepower: Fractional.
   c. Power: 120-V ac, 60 Hz, single phase.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Yard-Type, Fire-Department Connection:

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

   a. Fire-End & Croker Corporation.
   b. Fire Protection Products, Inc.
   c. Guardian Fire Equipment, Inc.
   d. Tyco Fire & Building Products LP.
   e. Potter Roemer.

2. Standard: UL 405.
3. Type: Exposed, freestanding.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.

6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department si□es and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, floor type.
9. Outlet: Bottom, with pipe threads.
10. Escutcheon Plate Marking: Similar to "AUTO SPKR."
11. Finish: Polished chrome plated.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Si□e: Same as connected piping.
5. Inlet and Outlet: Threaded.

B. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Si□e: Same as connected piping.
5. Inlet and Outlet: Threaded.

C. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Si□e: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

D. Flexible, Sprinkler Hose Fittings:

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

   a. Fivalco Inc.
   b. FlexHead Industries, Inc.
   c. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Flexible connectors shall have materials suitable for system fluid. Include 250-psigminimum working-pressure rating and ends according to the following:

   a. NPS 2and Smaller: Threaded.
   b. NPS 2-1/2and Larger: Flanged.

c. Option for NPS 2-1/2and Larger: Grooved for use with grooved-end-pipe couplings.

4. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid and UL Listed or FM Approved. Include steel nipples or flanges, welded to hose.

2.9 SPRINKLERS

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

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP.
3. Venus Fire Protection Ltd.
4. Victaulic Company.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

E. Sprinkler Finishes:

1. Chrome plated.
2. Bron□e.
3. Painted.

F. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Standard: UL 464.
2. Type: Vibrating, metal alarm bell.
3. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

F. Indicator-Post Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.11 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0 to 250 psig minimum.

D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe si□es.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Drain dry-pipe sprinkler piping.

N. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.

O. Fill wet pipe sprinkler system piping with water.

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
3. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

    a. Install air compressor and compressed-air supply piping.
    b. Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
    c. Install compressed-air supply piping from building's compressed-air piping system.

3.7 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install building mounted, fire-department connection in location directed by local authority.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.13 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be the following:

1. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

E. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 8, shall be one of the following:

1. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.14 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as required.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where required.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
3. Residential Sprinklers: Dull chrome.
4. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

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SECTION 220510 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

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

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

1.5 GENERAL REQUIREMENTS

A. In general, the lines to be installed by the various trades under these specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of various lines and ducts and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.

B. All piping for the plumbing trade shall be concealed in chases in finished areas, except as indicated on the drawings. Hori□ontal lines run in areas that have ceilings shall be run concealed in those ceilings, unless otherwise specifically indicated or directed.

C. Piping may be run exposed in machinery and equipment spaces, where serving as connections to equipment items in finished rooms where exposed connections are required, and elsewhere as indicated on the drawings or required.

D. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.

E. The plumbing plans do not give exact details as to elevations of lines and ducts, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to provide proper grading of lines, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.

F. The plumbing plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections. Minor relocations necessitated by the conditions at the site or as directed by the Architect shall be made without any additional cost accruing to the Owner.

G. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

H. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any

portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

I. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment which any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

J. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.

K. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:

1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
3. Large ducts and pipes with critical clearances.
4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.

L. Piping serving outlets on items of equipment shall be run in the most appropriate manner. Where the equipment has built-in chases, the lines shall be contained therein. Where the equipment is of the open type, the lines shall be run as close as possible to the underside of the top and in a neat and inconspicuous manner.

M. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.

N. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.

O. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.

P. Each bidder shall examine the plans and specifications for the General Construction. If these documents show any item requiring work under Division 22 and that work is not indicated on the respective "P" drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Plans in accordance with the specifications.

Q. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and

measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.

R. The accompanying plans do not indicate completely the existing mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.6 SUBMITTALS

A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.

B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.

C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.

D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.

E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.7 PERMITS, FEES, ETC.

A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.8 LAWS, CODES, AND ORDINANCES

A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.9 TESTING

A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.10 COORDINATION OF TRADES

A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 22 which require electrical connections shall be coordinated with Division 26 for:
1. Voltage
2. Phase
3. Ampacity
4. No. and size of wires
5. Wiring diagrams
6. Starter size, details and location
7. Control devices and details

B. Items furnished under various sections which require plumbing connections shall be coordinated for services, pressure, size and location of connections, type of fuel, clearances for service, auxiliary devices required, etc.

C. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.

D. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.

E. All items specified under Division 22 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.

F. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

H. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified by Architect.

1.11 CUTTING AND PATCHING

A. All cutting and patching for work under Division 22 shall be done by the Contractor under the section for which the trade is specified.

1.12 QUALITY ASSURANCE

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

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

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

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

1.13 SUBSTITUTIONS

A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.

B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.

C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.14 INSTALLATION DRAWINGS

A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.

B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 OPERATING INSTRUCTIONS

A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.17 OPERATING MANUALS

A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.

B. Manuals shall contain the following data:

1. Catalogue data of all equipment.
2. Shop drawings of all equipment.
3. Temperature control drawings (reduced in size)
4. Start-up instructions for major equipment.
5. Trouble shooting procedures for major equipment.
6. Wiring diagrams.
7. Recommended maintenance schedule for equipment.
8. Parts list for all items.
9. Name and address of each vendor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Bra□ing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty bra□ing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same si□e as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same si□e as piping to be joined, and corrosion-resistant metal band on each end.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 MECHANICAL SLEEVE SEALS

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

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.8 ACCESS DOORS

A. Wherever plumbing equipment is installed and where future access is required through either walls or ceilings and such cannot be obtained through the removable ceiling or through other means, the Contractor shall provide Milcor Style "M" access doors at least 12 inches by 12 inches in size or larger if required for access. Provide access doors for all valves, etc. Provide Milcor Style "UFR" rated access panels as required for installation in rated construction.

2.9 ESCUTCHEONS

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

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 LOCATION AND DETECTION

A. Below ground:

1. Non-Metallic: Non-metallic pipe installed below ground shall have installed in the same trench a detectable plastic tape that conforms in to the APWA color coding as follows:
   a. Orange – Telecommunications
   b. Blue – Water
   c. Green – Sanitary and Sewer Systems
   d. Yellow – Gas
2. Such tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be approved 2 1/8" wide and shall be imprinted with a continuous traceable for a minimum of eight years after direct burial. Product shall be Terra Tape Detectable or approved equal. Tape shall be installed per manufacturer's instructions, but no less than 12" above the buried line.
3. Provide 16 gauge direct burial tracer wire with all non-metallic underground pipe. Wire shall be single strand, 14 gauge minimum with 4/64" vinyl insulation which is UL approved for direct underground burial when used in a National Electric Code Class II circuit.

B. Metallic:
1. Below ground metallic piping shall have identifying tape similar to that specified for below ground non-metallic except that the aluminum foil for location is not required.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Bra□ed Joints: Construct joints according to AWS's "Bra□ing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus bra□ing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.
4. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

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

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.7 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

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

C. Paint all exposed pipe, cabinets, hangers and supports, and miscellaneous metal.

D. Paint all insulated surfaces exposed to view, including piping, equipment, etc. si□e surfaces until a smooth, non grainy surface is obtained.

E. Generally, painting is required on all surfaces such that no exposed bare metal or insulation surface is visible.

F. Paint all surfaces above or behind perforated return air grilles or other open spaced air outlet devices with flat black paint. All pipes, conduits, ductwork and structural members shall be painted. These surfaces shall be painted a distance away from the grille such that no unpainted surfaces are visible to a person standing on the room side and viewing through the device.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 220510

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SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Bronze globe valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball and plug valves open to minimize exposure of functional surfaces.
4. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Manufacturers:

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

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

B. All domestic water valves shall be certified as Lead-Free.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Si□es: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.

F. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

G. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Lead-Free, Full-Port, Bron□e Ball Valves with Bron□e Trim:

1. Description:

a. Standard: MSS SP-110.

b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bron□e.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bron□e.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 150, Lead-Free, Bron□e Swing Check Valves with Bron□e Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Hori□ontal flow.
d. Body Material: ASTM B 62, bron□e.
e. Ends: Threaded.
f. Disc: Bron□e.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper si□e, length, and material. Verify that gasket is of proper si□e, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in hori□ontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In hori□ontal position with hinge pin level.

3.3 ADJUSTING

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

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.
2. Throttling Service: Ball valves.
3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bron□e swing check valves with bron□e disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

END OF SECTION 220523

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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

a. Cooper B-Line, Inc.
b. Flex-Strut Inc.
c. Thomas & Betts Corporation.
d. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Cadmium plated steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.

C. For Trape□e or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvani□ed.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trape□e Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of hori□ontal piping, and support together on field-fabricated trape□e pipe hangers.

1. Pipes of Various Si□es: Support together and space trape□es for smallest pipe si□e or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 1 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp si□ed to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Hori□ontal Travelers (MSS Type 58): For supporting piping systems subject to linear hori□ontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trape□e Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trape□e support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Hori□ontal (MSS Type 54): Mounted hori□ontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trape□e (MSS Type 56): Two vertical-type supports and one trape□e member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.3 SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

1.4 COORDINATION

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

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodi□ed aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Si□e: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

END OF SECTION 220553

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SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the plumbing piping.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

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

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

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

2.3 ADHESIVES

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

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

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

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

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.7 TAPES

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

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

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

B. Insulation Installation on Pipe Flanges:

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

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

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

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. All Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick, ASJ, vapor seal all insulation.

B. Domestic Hot and Recirculated Hot Water:

1. Sizes 1-1/4” and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick, ASJ.

2. Sizes 1-1/2” and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick, ASJ. In chase walls where 1-1/2” thick insulation does not fit on runout piping ½” thick insulation is acceptable.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Piping.
2. Transition fittings.
3. Dielectric fittings.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Architect's written permission.

1.6 COORDINATION

A. Coordinate si□es and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe si□es.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bron□e Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:

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

1) Elkhart Products Corporation; Industrial Division.
2) NIBCO INC.
3) Viega; Plumbing and Heating Systems.

b. ProPress Bronze Fittings: ½” thru 4” - ASME B16.18 and NSF 61, or NSF 61-G or cNSF□us-pw with Smart Connect (SC) feature and EPDM sealing element.
c. ProPress Copper Fittings: ½” thru 4” - ASME B16.22 and NSF 61, or NSF 61-G or cNSF□us-pw, with Smart Connect (SC) feature and EPDM sealing element.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Bra□ing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty bra□ing unless otherwise indicated.

C. ProPress fittings shall be joined utili□ing appropriately si□ed Ridged Press Tools.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same si□e as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 150 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

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

a. Elster Perfection.
b. Grinnell Mechanical Products.
c. Matco-Norca, Inc.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66
b. Electroplated steel nipple. complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install all underground piping on 6” sand bed.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level with 0.25 percent slope downward toward drain.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install thermostats in hot-water circulation piping.

Q. Install thermometers on inlet and outlet piping from each water heater.

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

S. Install sleeve seals for piping penetrations of concrete walls and slabs.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Bra□ed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Bra□ed Joints" Chapter.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

F. ProPress Joints: shall be installed per the following installation guidelines:

1. Copper tube ends shall be cut square. The inside of the tube end shall be reamed to the full inside diameter of the tube and the outside of the tube end chamfered to remove any outside burrs. The outside of the tube end shall be cleaned with a clean cotton cloth to remove grease oil or dirt.

2. Fittings shall be inspected to make sure the sealing element is properly seated into the fitting. The sealing element is pre lubricated with a food grade lubricant. No field lubrication shall be applied to the sealing element.

3. Copper tube ends shall be inserted into the fitting to the full insertion depth of the fitting cup. A mark shall be made on the tube wall at the interface of the tube and fitting. Always insure the tube is fully inserted into the fitting prior to pressing the joint.

4. Always make sure the appropriately si□ed jaw or ring and actuator is selected for the joint being pressed. The Ridged XL Ring Kit shall be used to press 2-1/2” thru 4” bronze fittings. A Ridged XLC Ring Kit shall be used to press 2-1/2” thru 4” copper fittings.

5. Installers shall attend a Viega installation training class prior to installation.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in hori□ontal piping, and where required to drain water piping.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 and Smaller: Fitting-type coupling.
2. NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in si□es indicated, but not smaller than si□es of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in si□es indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection si□es.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
5. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

A. Under-building-slab, domestic water piping shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.

2. PEX Piping

B. Aboveground domestic water piping shall one of be the following:

1. All Sizes: Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Type L copper with ProPress fittings with Smart Connect (SC) feature and EPDM sealing element.

3.14 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Backflow preventers.
2. Water hammer arresters.
3. Air vents.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 REFER TO PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL SPECIALTIES

2.2 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

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

a. Josam Company.
b. MIFAB, Inc.
c. PPP Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper Shell, hydro-pneumatic air cushion and O-Ring sealed piston.
4. Size: PDI WH-2010 Sizes A through F.

2.3 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe

diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

E. Install water hammer arresters in water piping according to PDI-WH 201.

F. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly, and, double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

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SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

C. Cast Iron Soil Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval from the engineer.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste 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 sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install underground piping on 6” sand bed.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install steel piping according to applicable plumbing code.

P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground PVC piping according to ASTM D 2321.

T. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

V. Install sleeves for piping penetrations of walls, ceilings, and floors.

W. Install sleeve seals for piping penetrations of concrete walls and slabs.

X. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for hori□ontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for hori□ontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, hori□ontal piping runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Hori□ontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trape□e.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support hori□ontal piping and tubing within 12 inches of each fitting □□□□ and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one si□e for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for PVC piping with the following maximum hori□ontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

F. Install supports for vertical PVC piping every 48 inches.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection (8 hours), water level must not drop more than 1”. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.9 PIPING SCHEDULE

A. Aboveground, soil and waste piping shall be the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

B. Underground, soil, waste, and vent piping shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Miscellaneous sanitary drainage piping specialties.
2. Flashing materials.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 REFER TO PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL SPECIALTIES

2.2 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Same as connected piping, with inlet and outlet matching connected piping and cleanout.
2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch- minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install deep-seal traps on floor drains and other waste outlets.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221330 - CHEMICAL-WASTE PIPING

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 piping and specialties for the following systems:
   1. Chemical-waste and vent, gravity-flow, nonpressure piping system designated "chemical waste."

1.3 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Rating: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For chemical-waste piping materials, components, and specialties and for neutrali□ation systems.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain pipe, fittings, and joining materials for each piping system through one source from a single manufacturer.

B. Product Options: Drawings indicate si□e, profiles, and dimensional requirements of chemical-waste specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Piping materials shall bear label, stamp, or other markings of specified testing laboratory.

D. Comply with ASME B31.3, "Process Piping."

E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Special drainage systems for corrosive chemical or acid waste shall be equal to CPVC Type IV, ASTM Cell Classification 23447 from Spears® Manufacturing Company.

B. Dimensions: All pipe shall be Schedule 40 CPVC manufactured to dimensional requirements of ASTM F441. All pipe markings shall be accompanied by a yellow stripe for identification of CPVC chemical waste system. All fittings shall be CPVC drainage patterns meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer's specifications. CPVC system shall be available in sizes 1-1/2 through 24-inch iron pipe size (IPS) dimensions.

C. Joining Method: Joining method for pipe and fittings shall be solvent cement welding. Solvent cement shall be a "one-step" primerless type CPVC cement designated by the system manufacturer, specially formulated for resistance to corrosive chemicals and manufactured in accordance with ASTM F493. Mechanical connections for special equipment connection or transition to other system materials shall be as specified by the CPVC system manufacturer.

D. Flame & Smoke Conformance Rating: All molded fittings shall be CAN/ULC S102.2 Listed for flame spread and smoke development and rating designated on the original package labeling. All pipe shall be CAN/ULC S102.2 Listed for flame spread and smoke development with rating designated on the pipe marking.

E. Special Requirements & Approvals: All pipe, fittings, and cement shall be supplied together as a complete system certified by the NSF international for use in corrosive waste drainage systems as a Special Engineered (SE) Product. Installation shall be in accordance with the manufacturer's instructions and all applicable codes. Special drainage system to be equal to Spears® LabWaste™ CPVC Corrosive Waste Drainage Systems manufactured by Spears® Manufacturing Company

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Chemical-Waste and Vent Piping: Use the following piping materials for each size range:
1. NPS 1-1/2 to NPS 4: CPVC drainage piping with solvent cement welded joints.

3.2 SPECIALTY INSTALLATION

A. Install neutralization tanks on smooth and level foundation or floor surface. Include full initial charge of limestone.

3.3 PIPING INSTALLATION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping installation.

B. Install piping next to equipment, accessories, and specialties to allow service and maintenance.

C. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction. If specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
1. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
2. Individual, Straight, Horizontal Piping Runs:
a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports."

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

F. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2: 33 inches with 3/8-inch rod.
2. NPS 2-1/2 and NPS 3: 42 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

G. Install supports for vertical CPVC piping every 72 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect chemical-waste piping to sinks, specialties, accessories, and equipment. Use chemical-resistant coupling, adapter, or fitting as required for materials being joined.

3.7 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in Division 15 Section "Basic Mechanical Materials and Methods."

3.8 FIELD QUALITY CONTROL

A. Chemical-Waste Piping Inspection:
   1. Do not enclose, cover, or put drainage and vent piping into operation until it is inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping system before concealing after system roughing-in and before setting fixtures and equipment.
      b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspections: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Chemical-Waste Piping Testing: Test systems according to procedures of authorities having jurisdiction or, in absence of published procedure, according to the following:
   1. Test for leaks and defects in new piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Rough Plumbing Test Procedure: Test piping at completion of piping roughing-in. Tightly close all openings in piping system, and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before test starts through completion of test, water level must not drop. Inspect joints for leaks.
   4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Clean piping by flushing with potable water.

END OF SECTION 221330

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

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. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Three years.

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:

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

a. Lochinvar Corporation.
b. PVI Industries, LLC.
c. Rheem Manufacturing Company.
d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
e. State Industries.

2. Standard: UL 1453.
3. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.

a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
c. Insulation: Comply with ASHRAE/IESNA 90.1.
d. Jacket: Steel with enameled finish.
e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
f. Temperature Control: Adjustable thermostat.
g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.

h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

H. Shock Absorbers: ASSE 1010 or PDI-WH 201, Si□e A water hammer arrester.

I. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

J. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

K. Circulating Pump:

1. Furnish and install, as shown on the plans, Armstrong Compass R variable speed circulating pump. This model shall be an EMC motor with permanent magnet core rotor. Compass shall have 8 operation modes and front accessible wiring terminal box.
2. The 8 modes include Auto, 4 sensorless performance curve and 3 fixed speed. Mode selection shall be based on the application and expected duty point. The pump shall have a stainless steel body and PA66 impeller. The pump shall have a capacity of 5 US gpm against a total head of 15 ft. Armstrong Compass Series are 115V/single phase/60 H□ and are cETLus listed.
3. Stainless steel Compass is NSF 372 certified which complies with Section 116875 of the California Health and Safety Code and Vermont Act 193. (Lead content of all wetted surface is 0.25% or less.).
4. Provide pump with digital 7-day programmable timer for pump control.
5. The pump shall be supported such that the weight of the pump is not carried by the adjoining pipe.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters.

F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

G. Fill electric, domestic-water heaters with water.

H. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authori□ed service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 223300

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

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. Gas-fired, tankless, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

D. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: One year.

PART 2 - PRODUCTS

2.1 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

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

1. A. O. Smith Corporation.
2. Rheem Manufacturing Company.
3. Rinnai Corporation.
4. State Industries.
5. Takagi.

B. The fully modulating, on-demand, condensing gas fired tankless water heater(s) shall be A.O. Smith model CT-199, having a maximum input rating of 199,000 Btu/h and available in NG or LP. The heater shall have □ in. male NPT water and gas connections. The inlet gas supply pressures shall be 4.0 in. WC (min.) up to 10.5 in. WC (max) for NG and 8.0 in. WC (min.) up to 14 in. WC (max.) for LP. The indoor heater(s) shall incorporate an integrated temperature controller that will provide diagnostic information, fault history, and heater set temperature. The outdoor heater(s) shall be factory supplied with a temperature remote, 100112572, that can be installed up to 400 ft. from the heater using 18 gauge (minimum) control wire. The temperature remote shall provide diagnostic information, fault history, and heater set temperature. The heater(s) shall operate using 120 V / 60 H□ power source. The indoor heater(s) will incorporate a factory installed power cord.

C. The indoor heater(s) shall be vented with 3” or 4” diameter schedule 40 PVC, CPVC, ABS, or Category IV vent pipe with a length not to exceed 70 ft. (equivalent) for 3” vent or 100 ft. (equivalent) for 4” vent, terminating horizontally or vertically. The intake pipe may use material such as PVC, ABS, aluminum, or Category IV pipe and cannot exceed 70 ft. (equivalent) for 3” vent or 100 ft. (equivalent) for 4” vent. The outdoor heater(s) shall be constructed with an integral exhaust vent on the front of the heater.

D. The water heater(s) shall use a commercial-grade copper, fin tube primary heat exchanger with quick release brass or bron□e waterways. The secondary heat exchanger shall be constructed from stainless steel 316L. The heater(s) shall be controlled by an on-board solid-state printed circuit board which uses the following factory installed components: thermistors to monitor water temperature and exhaust temperature; a flow sensor to measure flow rate; a flame sensor to monitor combustion; an Air-Fuel Ratio Rod to measure and adjust air input in order to maintain optimal combustion efficiency. The heater also consists of in-line fusing and surge absorbers for electrical surge protection, an electronic spark igniter, alumini□ed stainless steel burners, hi-limit temperature switches to monitor water and exhaust temperatures, modulating gas valve, dual

freeze protection that will automatically fire the heater (indoor model only) and use heating blocks to protect the heat exchanger, and an overheat cutoff fuse.

E. The heater(s) can manifold to Easy-Link up to 4 heaters to provide additional capacity. The Easy-Link controls shall be built onto the on-board solidstate printed circuit board and does not require external controls. The linking control wire shall be supplied with the heater. The heater(s) can use a Multi-Unit controller, 100112691, to manifold 5-20 heaters. The Easy-Link and Multi-Unit Controller shall modulate the system for the most efficient performance. The Easy-Link and Multi-Unit Controller shall rotate the priority heater every 12 hours of operation time or 100 starts for balanced duty/cycle operation.

F. The heater models are design certified by CSA according to ANSI Z21.10.3 • CSA 4.3, approved for sale in the United States, ENERGY STAR• qualified, has a minimum uniform energy factor of 0.93, meets the energy efficiency requirements of the U. S. Department of Energy and ASHRAE 90.1, complies with SCAQMD Rule 1146.2 and other air quality districts with similar requirements for low NOx emissions of 14 ng/J or 20 ppm, and shall be certified to NSF 5 standards.

2.2 COMPRESSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

2.3 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.

1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

E. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

F. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4. Drain pans shall be a minimum of 3” deep.

G. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

H. Circulating Pump (HWCP):

1. Furnish and install, as shown on the plans, Armstrong Compass Design Envelope variable speed circulating pump. This model shall be an ECM motor with permanent magnet core rotor. Compass shall have 8 operation modes and front accessible wiring terminal box.
2. The 8 modes include Auto, 4 sensorless performance curve and 3 fixed speed. Mode selection shall be based on the application and expected duty point. The pump shall have a stainless steel body and PA66 impeller. The pump shall have a capacity of 5 US gpm against a total head of 15 ft. Armstrong Compass Series are 115V/single phase/60 H□ and are cETLus listed.
3. Stainless steel Compass is NSF 372 certified which complies with Section 116875 of the California Health and Safety Code and Vermont Act 193. (Lead content of all wetted surface is 0.25% or less.).
4. Provide pump with digital 7-day programmable timer for pump control.
5. The pump shall be supported such that the weight of the pump is not carried by the adjoining pipe.

2.4 PLASTIC VENT MATERIALS

A. CPVC Plastic, Schedule 40 Pipe: ASTM F 441/F 441M.

1. CPVC Plastic, Schedule 40 Fittings: ASTM F 438, socket type.
2. CPVC Solvent Cement: ASTM F 493.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Domestic-Water Heater Mounting

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.

2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.

D. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 36 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters.

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Division 22 Section "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 224100 - PLUMBING FIXTURES

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 plumbing fixtures and related components:

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Refer to Drawings for Plumbing Fixture Schedule.

B. Manufacturers for plumbing fixtures and related trim

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

a. Fixtures:
   1) Kohler Co.
   2) American Standard Co.
   3) Sloan Valve Company
   4) Bradley
   5) Acorn
   6) Moen Commercial
   7) Willoughby

b. Faucets:
   1) T&S Brass
   2) Chicago Faucet
   3) Delta Commercial
   4) Sloan Valve Company
   5) Moen Commercial

c. Flushometers
   1) Sloan Valve Company
   2) Zurn Industries (AV)
   3) Toto

d. Seats
   1) Bemis Manufacturing
   2) Centoco Manufacturing
   3) Church

e. Sinks
   1) Elkay Manufacturing Co
   2) Just Manufacturing Co

f. Carriers
   1) Josam Company
   2) MIFAB, Inc.
   3) Smith, Jay R. Mfg
   4) Tyler Pipe; Wade Div
   5) Watts Drainage Products
   6) Zurn Plumbing Products Group

g. Drinking Fountains & Water Coolers

1) Halsey Taylor
2) Elkay Manufacturing
3) Acorn

h. Mop Basins
1) Stern-Williams
2) Fiat
3) Acorn

i. P-Traps, Stops and Supplies
1) McGuire Manufacturing
2) Kohler Co.
3) Brasscraft
4) Chicago Faucet
5) T&S Brass

C. Protective Shielding Piping Enclosures, provide on all sinks and lavatories with exposed trim:

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

a. Plumberex
b. TRUEBRO, Inc.

2. Description: Insulate per ADA 4.19.4 and or IBC all exposed lavatories drain piping, hot/cold stops and supplies. Protectors will consist of molded closed cell PVC, with anti-fungal and anti-microbial properties. To be one piece continuous smooth design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

D. Install wall-mounting fixtures with tubular waste piping attached to supports.

E. Install counter-mounting fixtures in and attached to casework.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Valves."

H. Install semi cast brass trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. Install trap-seal liquid in dry urinals.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install shower flow-control fittings with specified maximum flow rates in shower arms.

P. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

Q. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224100

SECTION 226659 – LABORATORY SAFETY DEVICE SYSTEM

PART 1 – GENERAL

1.1 SUMMARY:

A. Furnishings and installation of the Laboratory Safety Device System as shown on the Drawings as herein specified.

1.2 SCOPE OF WORK:

A. Provide a laboratory safety device system for each Science Room as shown on the Drawings.
B. Each system shall include, but not be limited to, a utility controller panel, solenoid valves, electrical contactor, remote emergency shut off button, gas detector and all interconnections. The Plumbing Contractor shall provide all materials. Installation shall be in accordance with Part 3 of this section.

1.3 CODES AND REGULATIONS:

A. NFPA 70, National Electrical Code.
B. NFPA 72, National Fire Alarm Code.
C. NFPA 90A, Installation of Air conditioning and Ventilation Systems.
D. CSA C22.2 NO 61010-1.
E. Local and State Building Codes.
F. All requirements of the local Authority Having Jurisdiction.
G. UL61010-1 3rd Edition – Electrical Equipment for Measurement, control and Laboratory Use

1.4 WARRANTY:

A. Provide a manufacturer's parts warranty covering 3 Years from date of completion.
B. Refer to Division 01 section "Warranties"

1.5 MANUFACTURER:

A. American Gas Safety is the basis of design. Approved equals meeting all specifications and drawing requirements are acceptable.
B. Separate components may be provided in lieu of the specified manufactured system. Including but not limited to enclosures, remote shut off buttons, contactors and solenoid valves. The system shall include all piping, wiring, conduits, and final connections for a complete operational system.

1.6 SUBMITTALS:

A. Comply with Division 01 Section "Submittals Procedures"
B. Product Data:
   1. Manufacturer
   2. Model Number
   3. Catalog Data sheet with Photographs
   4. Wiring and equipment connection diagrams clearly showing factory equipment and field installed equipment.
C. Provide all equipment, devices, conduit, operating power and other provisions for the Laboratory Safety System.
D. Shop Drawings
   1. Include plans, elevations, sections and mounting and attachments details.
   2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Wiring Diagrams

a. Detail wiring for signal, power and control wiring

E. Operation and Maintenance Data
   1. Include in Emergency, Operation and Maintenance manuals.
   2. Refer to Division 01 Section “Operation and Maintenance Data”
F. Manufacturer’s recommended detailed installation instructions.
G. Equipment is not to be ordered without approved submittals

PART 2 – PRODUCTS

2.1 PRODUCTS IN THIS SECTION:

All Products and Devices for a complete Laboratory Safety Device System with all components designed to operate together as a system. The system shall and be UL listed and labelled and be as listed in the Equipment Schedule of this Section.

2.2 MERLIN UTILITY CONTROLLER:

At each science classroom and elsewhere as shown on Drawings, provide a Utility Controller with fascia panel mounted switches to activate remote solenoids and relays to control natural gas, domestic water and electrical convenience outlets or other indicated services or devices. Utility Controller shall be certified to Underwriter’s Laboratory UL61010-1 3rd Edition Standards. Controller shall utili□e and operate a pressure transducer to perform a pressure drop test on the natural gas line before allowing gas to be supplied. Controller shall continuously check incoming gas supply pressure throughout operation. Controller shall provide line voltage signals for output circuits. Controller shall provide inputs for remote EPO’s and Gas Sensors. The Controller shall be equipped with an Authority Key Lock that restricts activation and de-activation of output signals to the instructor or educator. Controller shall be provided with a fascia mounted recessed EPO button. Basis of design AGS Merlin 1000SW

2.4 PRESSURE TRANSDUCER:

Each Controller shall be provided with a UL approved pressure transducer to be installed on the natural gas pipe, either via the solenoid valve or via a reducing fitting located as close to the solenoid valve as is permissible on the downstream side. Transducer shall be 12vdc powered by the utility control and shall provide a 0-12vdc return signal.

2.5 GAS SOLENOID VALVE:

At each science classroom and where shown on Drawings, Provide a Gas Solenoid Valve: UL Listed 429, CSA Certified, FM 400 liquid or gas safety shut-off valve. Aluminium body two-way normally closed valve rated for natural gas (methane) and LPG (liquid petroleum gas). Si□e to be same as pipe si□e indicated on plans, 120 volt ac single phase actuator, 15 watts, and 2 PSI maximum operating pressure capacity. Manufacturer: American Gas Safety (AGS) series MERLIN or equivalent

2.6 WATER SOLENOID VALVES:

Water solenoid valves shall be NSF apprd. Brass lead free, EPDM seal, 8W 120v 50-60HZ, Normally closed type with an operating pressure of 2-230PSI. Number of solenoids, intended use and pipe si□es are as noted in Equipment Schedule or Drawings. Basis of design AGS SOLVLV

2.7 ELECTRICAL CONTACTOR:

Electrical contactors shall receive signal from utility control panel to govern the electrical power going to the classroom receptacles. Associated circuits shall be ran from the electrical

panel, through the contactor to the receptacles. Contactor shall be rated for 20amp service and provide 4poles in a normally open configuration capable of receiving a 110v 3amp signal. Number of contactors, location, circuit numbers are as noted on the electrical panel schedule or drawings. Basis of design AGS CON4P20ANO or equivalent.

2.8 CONTACTOR ENCLOSURE:

Enclose contactors in a 16guage mild steel type 1 junction box. Ensure junction box is adequate si□e to accommodate required number of contactors. Locate enclosure above classroom ceiling close to doorway. Basis of design AGS CONENC10106

2.9 REMOTE PANIC BUTTON:

Where shown on Drawings and where classroom si□e and configuration restricts clear path from work areas to Utility Controller, provide a wall mounted Remote Panic Button. Button shall be red mushroom twist re-set type recessed in a yellow polycarbonate enclosure with a clear lift up protective shield. Button shall be UL listed and provide clear label text "Emergency Power Off". Assembly shall be located as shown on Drawings and as stipulated in Equipment Schedule. Integrate assembly with volt free dry contact input on Controller. Basis of design AGS EPOTW

2.10 FUEL GAS SENSOR:

Where shown on Drawings and in Equipment Schedule, furnish and install a NG (Methane) Gas Sensor to detect natural gas within the classroom. Detector to provide clear digital traffic light reading of %LEL value. Detector shall provide a local visual and audible alarm. Integrate Fuel Gas Sensor with low voltage input on Controller. Sensor quantity and location as per drawings and manufacturer's instructions. Basis of design AGS NGTFT

2.8 FAN CONTROL

Where shown on Drawings and in Equipment Schedule furnish and install a Manual Fan Control and Purge Fan activation panel. Panel to automatically run the fan when the Merlin utility controller is turned on or in alarm function with built in adjustable time parameters. Panel works with on / off fan assembly and two speed fans. Install as per drawings. Basis of design American Gas Safety Merlin FS1. Flush mount kit available AGSFMK500.

PART 3 – INTERGRATION AND CONFIGERATION

3.1 Exhaust Fan:

A. Where shown on Drawings, provide low voltage integration wiring from each Controller to connection point on Exhaust Fan controller. Alternatively utili□e permanent 12vdc output and BMS output to connect to a 12vdc relay to interrupt manual control of the exhaust fans. Final connection by others.

3.2 SYSTEM CONFIGURATION:

1. Utility Controllers shall be factory configured to the standard configurations and shall be capable of field adjustments to meet specific project modification requirements. Configurations are limited to DIP switch adjustments on rear of fascia panel without the requirement of additional equipment.
2. Classroom Utilities:
   Each utility service with outlets at student work-stations shall be controlled by independent output circuit at the Utility Controller. Control of services can be combined onto one output circuit as indicated on Drawings. Services shall be activated by Controller fascia panel master control switches and the engaging of the authority control key. Activation of utility services shall be restricted to the instructor by means of the authority key lock switch.

3. Time-Out Function:
   Each Controller be pre-set to shut down after either 2hrs, 4hrs 8hrs or have this function disabled. This configuration shall be adjusted via the DIP switches on the reverse side of the fascia panel.

4. Panic Alarm Re-Set:
   Unless stated elsewhere on Drawings, The Controller shall only re-set from panic alarm after engagement of the authority key on fascia panel and after local panic alarm has been re-set.

5. Fire Alarm Re-set:
   Unless stated elsewhere on Drawings, the Utility Controller shall be configured so that continued fire alarm signal to Controller shall prevent re-set.

6. Purge-Exhaust Fan:
   Where indicated by the Drawings, classrooms having an exhaust fan shall have fan configured with Utility Controller so that the fan will automatically purge classroom in case of emergency. Fan shall be integrated with Controller via the BMS output. Provide control wiring from Controller contacts to BMS and configure the Controller via the DIP switches on the reverse side of the fascia panel. See manufacturer's installation instructions for switch options

7. EPO's and Panic Buttons:
   Each Controller shall be configured so that pressing remote EPO or Panic Buttons will disable all utilities. If required; Water and Electrical utilities can be configured to stay on in an emergency. Each Controller shall be configured so that Gas services will automatically shut down in all alarm modes.

8. Fuel Gas Sensor:
   Where shown in Drawings, unit shall integrate with Controller and shut down all designated outputs. Each Controller can utili□e up to three fuel gas sensors.

PART 4 – EXECUTION

4.1 INSTALLATION:

A. Install in accordance with manufacturer's recommendations and instructions. Verify manufacturer's mounting heights to comply with local codes & standards.

B. Finish and install all devices as shown in Drawings and as specified herein. Where device is to be installed by other trades, furnish and then turn over to appropriate trade for installation.

C. Furnish, install and make final connections to monitoring and remote EPO's and Panic Buttons as indicated on Drawings and specified herein. Furnish and install low voltage and volt free control wiring from Utility Controller to connection point on BMS and Exhaust Fan controller. Final connection by others.

4.2 PLUMBING:

A. Make final connections to all piping systems where indicated by Drawings and specifications. Install in accordance with SECTION 221116

4.3 ELECTRICAL:

A. Electrical Contractor shall furnish all conduit and wiring, making final wiring connections to all equipment as indicated by Drawings and specifications. Contractor shall be responsible for all system configurations, integration, test and start-up.

PART 5 – SYSTEM TEST AND START-UP

A. Prior to placing the Utility Controller System into service, perform ALL Start-Up procedures and checklists as stated in Manufacturer's Operations and Maintenance Procedure

B. Verify that all components and devices comply with manufacturer's requirements and recommendations and that all devices and installations conform to Drawings and specification requirements.

C. Upon completion of ALL Start-Up tests, place the system into service. Complete all warranty registration documents. Submit originals with other project related closeout and O & M documentation. Review all operating procedures with a representative of the owner. Provide all System Authority Keys to the owner's representative.

PART 6 – EQUIPMENT SCHEDULE

Product	Model	Description	Remarks
Controller	1000SW+	Gas Water Electric	c/w pressure proving
Flush Mount Kit	AGSFMK	Rough in Box	
Gas Valve	MERLIN****	0-2PSI 110V NC NPT	Size Dependant
Water Valve	SOLVLV**	3.230PSI 110V NC NPT	HW, CW, HWR
Electrical Contactor	CON4P20ANO	4pole 20amp NO	Number per drawings
Contactor Enclosure	ENCCON10104	Metal Junction Box	Quarter turn latch
Panic Button	AGSEPOTW	Twit Release Clear Cover	Mount on single gang rough in box
Gas Detector	AGSNGTFT	Methane Detector	1 per room
Pressure Transducer	AGSPT	¼"NPT 0-100mb	c/w 1000SW+
Fan Control	AGSFS1	Manual Fan Control With Purge In Emergency	See plans

All sensors should be mounted for the desired gas requirements. Consult manufacturer for recommendations and requirements.

END OF SECTION 226659

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SECTION 230510 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general requirements for HVAC.

1.3 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

1.4 GENERAL REQUIREMENTS

A. In general, the lines and ducts to be installed by the various trades under these specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of various lines and ducts and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.

B. All piping and ductwork for the mechanical trade shall be concealed in chases in finished areas, except as indicated on the drawings. Hori□ontal lines run in areas that have ceilings shall be run concealed in those ceilings, unless otherwise specifically indicated or directed.

C. Piping and ductwork may be run exposed in machinery and equipment spaces, where serving as connections to equipment items in finished rooms where exposed connections are required, and elsewhere as indicated on the drawings or required.

D. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.

E. The mechanical plans do not give exact details as to elevations of lines and ducts, exact locations, etc., and do not show all the offsets, control lines, pilot lines and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to provide proper grading of lines, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.

F. The mechanical plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections. Minor relocations necessitated by the conditions at the site or as directed by the Architect shall be made without any additional cost accruing to the Owner.

G. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

H. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

I. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment which any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

J. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.

K. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:

1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
3. Large ducts and pipes with critical clearances.
4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.

L. Piping and ducts serving outlets on items of equipment shall be run in the most appropriate manner. Where the equipment has built-in chases, the lines shall be contained therein. Where the equipment is of the open type, the lines shall be run as close as possible to the underside of the top and in a neat and inconspicuous manner.

M. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.

N. Exceptions and inconsistencies in plans and specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.

O. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.

P. Each bidder shall examine the plans and specifications for the General Construction. If these documents show any item requiring work under Division 23 and that work is not indicated on the respective "M" drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Plans in accordance with the specifications.

Q. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.

R. The accompanying plans do not indicate completely the existing mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.5 SUBMITTALS

A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.

B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.

C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.

D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.

E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.6 PERMITS, FEES, ETC.

A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.7 LAWS, CODES, AND ORDINANCES

A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.8 TESTING

A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.9 COORDINATION OF TRADES

A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 23 which require electrical connections shall be coordinated with Division 26 for:
   1. Voltage
   2. Phase
   3. Ampacity
   4. No. and size of wires

5. Wiring diagrams
6. Starter size, details and location
7. Control devices and details

B. Items furnished under various sections which require plumbing connections shall be coordinated for services, pressure, size and location of connections, type of fuel, clearances for service, auxiliary devices required, etc.

C. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.

D. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.

E. All items specified under Division 23 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.

F. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

H. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified by Architect.

1.10 CUTTING AND PATCHING

A. All cutting and patching for work under Division 23 shall be done by the Contractor under the section for which the trade is specified.

1.11 QUALITY ASSURANCE

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

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

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

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

1.12 SUBSTITUTIONS

A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.

B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.

C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.13 USE OF SYSTEMS

A. It is considered that it will be necessary to operate the mechanical systems to provide heating and ventilation in portions of the building that are enclosed. As systems or portions of systems become operable, they shall be operated as required to maintain habitable conditions in enclosed portions of the building that are still under construction and portions that are fully complete as may be required to properly protect installed piping, equipment and finishes.

B. In order to provide protection to ducts, plenums, etc. install temporary filters over or in return air openings until all finished painting is completed. Protect supply outlets, coils, etc. as necessary in each case.

C. Except for operation of cooling equipment to prove its performance and to adjust and balance the systems, that equipment will not be operated for comfort of construction workers.

D. During warm weather the Contractor shall arrange for the operation of systems to supply 100 percent outside air. The systems controls shall be reset to their normal cycle of operation in each case during the times that heating is required and when the cooling equipment is operated.

E. Immediately prior to the time that the systems are to be accepted by the Owner, each system shall be carefully examined and if ductwork is dirty, it shall be carefully cleaned by men skilled in that type of work. All filters shall be put in first class condition by replacement of filters and/or other procedures as directed.

F. The use of the equipment for maintaining environmental and/or protective temperature conditions shall in no way constitute acceptance of that equipment and the connected piping, ducts, insulation, finishes, etc. by the Owner. Furthermore, it shall in no way shorten the guarantee period hereinafter specified. The Contractor shall either secure extended warranties from the vendors of equipment or shall purchase insurance to provide proper coverage on the equipment through the guarantee period and shall file with the Architect substantiating affidavits from equipment manufacturers or a copy of the insurance policy covering the equipment through the guarantee period. The personal underwriting of the Contractor for equipment manufacturers' warranties is not acceptable, but his personal underwriting of piping, ductwork, insulation and associated materials is acceptable subject to the provisions of the contract.

G. The Contractor shall provide such labor as may be required in the operation of the systems and shall pay all costs.

1.14 INSTALLATION DRAWINGS

A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.

B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 OPERATING INSTRUCTIONS

A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.17 OPERATING MANUALS

A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.

B. Manuals shall contain the following data:

1. Catalogue data of all equipment.
2. Shop drawings of all equipment.
3. Temperature control drawings (reduced in si□e)
4. Start-up instructions for major equipment.
5. Trouble shooting procedures for major equipment.
6. Wiring diagrams.
7. Recommended maintenance schedule for equipment.
8. Parts list for all items.
9. Name and address of each vendor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 MECHANICAL SLEEVE SEALS

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

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.8 ACCESS DOORS

A. Wherever mechanical and/or plumbing equipment is installed and where future access is required through either walls or ceilings and such cannot be obtained through the removable ceiling or through other means, the Contractor shall provide Milcor Style "M" access doors at least 12 inches by 12 inches in size or larger if required for access. Provide access doors for all fire dampers, smoke dampers, valves, etc. Provide Milcor Style "UFR" rated access panels as required for installation in rated construction.

2.9 ESCUTCHEONS

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

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

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

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

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

C. Paint all exposed pipe, cabinets, hangers and supports, and miscellaneous metal.

D. Paint all exposed sheet metal.

E. Paint all insulated surfaces exposed to view, including piping, equipment, etc. si□e surfaces until a smooth, non grainy surface is obtained.

F. Generally, painting is required on all surfaces such that no exposed bare metal or insulation surface is visible.

G. Paint all surfaces above or behind perforated return air grilles or other open spaced air outlet devices with flat black paint. All pipes, conduits, ductwork and structural members shall be painted. These surfaces shall be painted a distance away from the grille such that no unpainted surfaces are visible to a person standing on the room side and viewing through the device.

END OF SECTION 230510

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvani□ed.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trape□e Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of hori□ontal piping, and support together on field-fabricated trape□e pipe hangers.

1. Pipes of Various Si□es: Support together and space trape□es for smallest pipe si□e or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 1 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp si□ed to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trape□e pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping si□e limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimi□e distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if hori□ontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small hori□ontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod si□es are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Hori□ontal Travelers (MSS Type 58): For supporting piping systems subject to linear hori□ontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.

1.3 SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

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

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.

END OF SECTION 230553

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:

a. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Sample report forms.

C. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. with Owner during TAB operations to minimi□e conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly si□ed thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley si□es to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economi□er, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that □one.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.5 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.6 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Outdoor airflow in cfm.
g. Return airflow in cfm.
h. Outdoor-air damper position.

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.

j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and si□e.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, si□e in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and si□e.
b. Horsepower and rpm.
c. Volts, phase, and hert□
d. Full-load amperage and service factor.
e. Sheave make, si□e in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and si□e of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the duct services.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 COORDINATION

A. Coordinate si□es and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for

installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

2.2 ADHESIVES

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

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

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. 3M; Fire Barrier Wrap Products.
d. Unifrax Corporation; FyreWrap.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

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

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of hori□ontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed ducts.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1. **A RE TA U AR DU TS S A BE ED REFER TO SE T O – ETA DU TS**.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Commercial, Kitchen Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

B. **ROU D** Supply-air, Return-air, and Outside-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2-1/5 inches thick and 0.75-lb/cu. ft. nominal density with an installed R-Value of 6.0

END OF SECTION 230713

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SECTION 230719 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating all of the HVAC piping systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 COORDINATION

A. Coordinate si□es and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

Flexible Elastomeric Foam: EPDM - Closed cell expanded rubber. Comply with ASTM C 534, Type I for tubular materials for refrigeration pipe si□es 1/4" and greater.

1. Outdoor Use, Provide one of the following.
    a. Aeroflex, SSPT with 2 coats of field applied Aerocel Aerocoat, , allowing a minimum of 4 hours drying time before applying second coat
    b. . Armacell, LLC, AP Armaflex with 2 coats of field applied WB Finish, allowing a minimum of 4 hours drying time before applying second coat.
    c. Armacell, LLC, Armaflex Shield, with factory-applied jacketing
2. Indoor Use, Provide one of the following.
    a. Aeroflex, SSPT
    b. Armacell, LLC, AP Armaflex
    c. Armacell, LLC, Armaflex Ultra
3. Applied to Annealed Coiled Tubing (Line Sets), Basis of Design Product: EPDM continuous tube.

B. Elastomeric insulation shall not use CFC’s or HFC’s in the manufacturing process.

C. Elastomeric insulation shall have a flame spread-index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 for all products through 2” thickness.

D. Elastomeric insulation and elastomeric joining system shall be suitable of use to 250F for up to 96 hours, per ASTM C 411.

E. Elastomeric insulation shall have a maximum thermal conductivity of 0.26 Btu-in/h-ft2-F at a mean temperature of 75□F for thicknesses 1 inch or less, and a maximum thermal conductivity of 0.28 Btu-in/h-ft2-□F at a mean temperature of 75□F for thicknesses greater than 1 inch, when tested in accordance with ASTM C 177 or ASTM C 518.

F. Elastomeric insulation shall have a maximum water vapor transmission of ≤0.03 perm-inch

when tested in accordance with ASTM E 96, Procedure A, latest revision.

G. Elastomeric insulation must exhibit long-term UV resistance in outdoor installation per ASTM G 7 and ASTM G 90.

H. Elastomeric insulation must not contribute to external stress corrosion cracking when tested per ASTM C 692.

2.2 ADHESIVES

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

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

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.3 INSULATING PIPE HANGER SUPPORTS

A. Support the piping system using high density rigid foam insulating pipe hanger supports with an inner lining of EPDM rubber insulating tape and 15-mil exterior EPDM rubber jacket. Insulation density to be a minimum of 10 lb. / cu. ft. with a compressive strength of 284 PSI or greater, and a k-value of 0.312 or lower. Continuous use temperature range to be -70°F to 257°F with water absorption of 5% or less.

B. Basis of Design Product: Provide Reftekk “Cush-A-Therm”, model UX insulated pipe support complete with steel channel insulation OD clamp or comparable product by one of the following:
1. Aeroflex USA, Aerofix-U with matching steel channel insulation OD clamp.
2. Armaflex LLC, Armafix IPH with matching steel channel insulation OD clamp

2.4 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: [illegible]
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to size.
b. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
c. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.5 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of hori□ontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Insulating Pipe Hanger Supports are to be installed at all pipe support and clamp locations. Insulating Pipe Hanger Supports are to be installed at the time of piping installation such that the pipe insulation system is installed in a continuous manner through the pipe support system.

G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

H. Keep insulation materials dry during application and finishing.

I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

J. Install insulation with least number of joints practical.

K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversi□ed preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match si□e and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

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

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

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

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick. All joints must be glued as specified above (taping only is not acceptable).

B. VRV System Refrigerant Piping:

1. Flexible Elastomeric Insulation per the following sizes. All exterior and roof mounted piping shall also have aluminum jacket with stainless steel bands.

a. Liquid lines operating at temperatures less than 60 deg F:
   1) For pipe size up to 1” insulation wall thickness shall be ½” thick.
   2) For pipe sizes greater than 1” insulation wall thickness shall be 1” thick.
b. Gas lines:
   1) For pipe sizes up to 1.5” insulation wall thickness shall be 1.5”
   2) For pipe sizes greater than 1.5” insulation wall thickness shall be 2” thick.

END OF SECTION 230719

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SECTION 232113 – CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Condensate-drain piping.

1.3 SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe and fittings.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. DWV Copper Tubing: ASTM B 306, Type DWV.

2.2 PLASTIC PIPE AND FITTINGS

A. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends as indicated in Part 3 "Piping Applications" Article.

2.3 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Condensate-Drain Piping for Rooftop Units: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Condensate-Drain Piping for VRF System Units: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Install piping to allow application of insulation.

H. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

I. Install drain piping at a uniform grade of 1 percent downward in direction of flow.

J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

D. Install supports for vertical PVC piping every 48 inches.

E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 to NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod

3.4 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Nonpressure Piping: Join according to ASTM D 2855.

END OF SECTION 232113

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SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
2. Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

C. Installer Qualification: Only trained installers skilled in refrigeration pipe installation and bra□ing of copper tubing should be used.

1.6 PRODUCT STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 COPPER PIPE AND FITTINGS

A. Copper Tube Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.

B. Coiled Copper Tube: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Bra□ing Filler Metals: AWS A5.8.

F. Field Swaged Bra□ing Cups: MSS-SP-73, ASME B 16.50.

G. Field Bends (all angles): ASME B31.5.

H. Flexible Connectors:

1. Body: Tin-bron□e bellows with woven, flexible, tinned-bron□e-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Socket ends.
5. Working Pressure Rating: 700 psig.
6. Maximum Operating Temperature 250 deg. F
7. Valves must be specifically rated for R-410A.

2.3 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction and Liquid Lines for pipe runs from condensing units to branch selector boxes: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with brazed joints.

B. Suction and Liquid Lines for pipe runs from branch selector boxes to indoor units: Copper, Type ACR, O60 (soft annealed)-temper tubing and field bent fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves as shown on plans or as required to isolate system components.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

S. Install sleeve seals for piping penetrations of concrete walls and slabs.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

U. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.
2. Use Type Bag-5 (45% Ag), cadmium-free silver alloy for joining copper with bronze or steel. Use manufacturers recommended flux.

B. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only O60 (soft annealed) and H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015” brazing gap and a maximum of 0.005” brazing gap. Brazing cup depth for each tube size shall be as follows.

1/4"	3/8”	1/2"	5/8”	3/4"	7/8”	1-1/8”	1-3/8”	1-5/8”	2-1/8”
0.250”	0.280”	0.310”	0.390”	0.420”	0.460”	0.510”	0.560”	0.600”	0.700”

C. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum

diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only O60 soft annealed-temper and H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

D. BRAZING AND JOINING PROCEDURE

1. Tube ends shall be cut with a clean sharp tubing cutter.
2. Deburr the I.D. of the cut tube end with a clean deburring tool.
3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before bra□ing.
4. Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the bra□ing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.
5. Purge all tubing with oil free nitrogen while bra□ing and until cool to the touch. Use an oxygen analy□er to verify the absence of oxygen prior to bra□ing. The oxygen content shall be less than 1% before start of bra□ing.
6. Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.
7. Use the proper torch tip based on tube si□e as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.
8. Post Bra□ing Cleaning: Exterior of all completed joints shall be washed with a water soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual hori□ontal runs less than 20 feet long.
2. Rigid high compressive strength foam insulating pipe support at all support points. Comply with Section 230719 “DX Piping System Insulation”.
3. Do NOT attach hangers directly to pipe or tube.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod si□es:

1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod si□e, 3/8 inch.
2. Greater than 3/4" thru 1” OD: Maximum span, 72 inches; minimum rod si□e, 3/8 inch.
3. Greater than 1” thru 2-1/8” OD: Maximum span, 96 inches; minimum rod si□e, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system as recommended by equipment manufacturer.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Sealants and gaskets.
5. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1. Static-Pressure Classes:

a. Supply Ducts: 1.5-inch wg.
b. Return Ducts (Negative Pressure): 1.5-inch wg.
c. Exhaust Ducts (Negative Pressure): 1.5-inch wg.
d. Kitchen Grease Ducts (Negative Pressure): 6-inch wg.
e. Kitchen Dishwasher Ducts (Negative Pressure): 2-inch wg.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.5 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Formed-On Flanges: Ducts with transverse duct joints 28” and larger shall be constructed according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. The installation of flanged system shall be in accordance with the manufacturers printed instruction and installation manuals.
3. Construction of the duct, such as gauge, reinforcing, etc., shall be as indicated in the addendum to the SMACNA manuals as provided by the manufacturer and as tested by Pittsburgh Testing Laboratory.

F. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvani□ed Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvani□ed Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphati□ed.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvani□ed.

1. Where black- and galvani□ed-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvani□ed steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 DUCT LINER FOR ALL RECTANGULAR DUCTS AND PLENUMS

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

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

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.
e. Maximum Thermal Conductivity:

1) Type I, Flexible: 0.16 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Exposed round ducts shall be paint grip spiral wound ductwork with 1” thick liner. Liner shall be equal to Johns Manville Spiracoustic Plus Round Duct Liner System installed per manufacturers requirements. The ducts sizes shown on plan are internal free area size so metal size shall be 2” larger to accommodate for duct lining.

D. Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

10. The si□es of the ducts indicated are actual internal si□es and the sheet metal si□es shall be 3" greater in both dimensions to accommodate the lining. No voids are permitted.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plastici□er.

D. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Si□es: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Si□e," and Table 4-2, "Minimum Hanger Si□es for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trape□e and Riser Supports:

1. Supports for Galvani□ed-Steel Ducts: Galvani□ed-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to si□e ducts and calculate friction loss for air-handling equipment si□ing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated bolted and gasketed access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

D. The Contractor shall make final connections to all equipment. Where black steel mates with stainless steel, use companion flanges gasketed or bolted.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated bolted and gasketed access panel assemblies at each change in direction and at maximum intervals of 12 feet in hori□ontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

D. The Contractor shall make final connections to all equipment. Where black steel mates with stainless steel, use companion flanges gasketed or bolted.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as follows:
   1. Commercial Kitchen Hood Exhaust Ducts: Comply with NFPA 96.
      a. Concealed: 16 gauge carbon-steel sheet for ducts with cross section smaller than 2 sq. ft. and 14 gauge carbon-steel sheet for ducts with cross section larger than 2 sq. ft.
      b. Welded seams and joints.
   2. Dishwasher Hood Exhaust Ducts:
      a. Type 304, stainless-steel sheet.
      b. Exposed to View: No. 4 finish.
      c. Concealed: No. 2D finish.
      d. Welded seams and flanged joints with watertight EPDM gaskets.
      e. Provide a condensate drain connection to all low points with a drain line extending to the floor drain.

B. Intermediate Reinforcement:

1. Galvani□ed-Steel Ducts: Galvani□ed steel.
2. Stainless-Steel Ducts: Galvani□ed steel.

C. Liner:

1. RECTANGULAR DUCTS (SUPPLY, RETURN AND OUTSIDE AIR) AND ALL AIR PLENUMS: Fibrous glass, Type I, 1-1/2 inches thick.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows." The use of radius elbow with square inner throat is NOT acceptable for any duct velocities.

   a. Velocity 1000 fpm or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm:

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Turning vanes.
3. Flexible connectors.
4. Flexible ducts.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvani□ed Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvani□ed Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphati□ed.

C. Reinforcement Shapes and Plates: Galvani□ed-steel reinforcement where installed on galvani□ed sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvani□ed steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
2. Wherever the ducts are rendered inaccessible behind non-removable ceilings or furrings, or other construction that is not easily removable to permit access to the ducts, the devices shall be equal to Young Regulator Co. No. 1200 right angle worm gear regulator with 301 concealed damper regulator. On exposed or easily accessible ducts the adjusting devices shall be equal to Young No. 1 or No. 900 and shall be fastened to the duct

C. Single-blade Volume Dampers: For dampers where neither dimension exceeds 24”, standard leakage rating, and suitable for hori□ontal or vertical applications.

1. Steel Frames: Hat-shaped, galvani□ed sheet steel channels, minimum of 22 gage, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 22 gage, galvani□ed sheet steel.
3. Blade Axles: Galvani□ed steel.
4. Bearings: Molded synthetic.

D. Multiple-blade Volume Dampers: For dampers where either dimension exceeds 24”, opposed-blade, standard leakage rating, and suitable for hori□ontal or vertical applications.

1. Steel Frames: Hat-shaped, galvani□ed sheet steel channels, minimum of 16 gage, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 16 gage, galvani□ed sheet steel, maximum 12” wide.
3. Blade Axles: Galvani□ed steel.
4. Bearings: Molded synthetic.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick □inc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod si□e. Include elevated platform for insulated duct mounting.

2.3 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvani□ed sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 36 inches wide and double wall for larger dimensions.

2.4 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

    a. Double wall, rectangular.
    b. Galvani□ed sheet metal with insulation fill and thickness as indicated for duct pressure class.
    c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvani□ed sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.5 FLEXIBLE CONNECTORS

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

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvani□ed sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 o□/sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

A. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 o□/sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.6 FLEXIBLE DUCTS

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

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Thermaflex.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Low Pressure, Insulated, Flexible Duct: UL 181, Class 1, made and composed of a CPE liner duct permanently bonded to a coated spring steel wire helix and supporting a fiber glass insulating blanket. Low permeability outer vapor barrier of fiber glass reinforced film laminate shall complete the composite.

1. Pressure Rating: 8-inch wg positive and 1-inch negative.
2. Maximum Air Velocity: 4000 fpm.
3. R-Value: 4.2
4. Temperature Range: Minus 20 to plus 250 deg F.
5. Example: Thermaflex M-KE

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in si□es 3 through 18 inches, to suit duct si□e.

2.7 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Si□e to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvani□ed-steel accessories in galvani□ed-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install flexible connectors to connect ducts to equipment.

G. Install duct test holes where required for testing and balancing purposes.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Si□es:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

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. Inline centrifugal fans.
2. Centrifugal roof ventilators
3. Ceiling-mounting ventilators

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Greenheck.
2. Loren Cook Company.
3. Twin City.
4. Penn Ventilation.

2.2 IN-LINE CENTRIFUGAL FANS

A. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

D. Accessories:

1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Fan Speed Controller mounted on unit.

2.3 CENTRIFUGAL ROOF VENTILATORS

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

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Welding Exhaust Fans: The fans shall be explosion proof.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Metal roof curb compatible with metal roof.

1. Overall Height: 14 inches.
2. Pitch Mounting: Manufacture curb for roof slope.
3. Metal Liner: Galvani□ed steel.
4. Provide curb compatible with metal roof. Coordinate exact requirement with roof supplier.

2.4 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
2. Isolation: Rubber-in-shear vibration isolators.
3. Fan Speed Controller.
4. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23.

1. Motor Si□es: Minimum si□e as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Support units using elastomeric mounts having a static deflection of 1 inch.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

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SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS

A. Grilles and registers shall be furnished and installed as scheduled on the drawings.

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

a. Kreuger.
b. METALAIRE, Inc.
c. Nailor Industries Inc.
d. Price Industries.
e. Titus.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 233813 - COMMERCIAL-KITCHEN HOODS

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 Type I commercial kitchen hoods.

1.3 DEFINITIONS

A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.

B. Type I Hood: A hood designed for grease exhaust applications.

1.4 SUBMITTALS

A. Product Data: For the following:
1. Standard hoods.
2. Filters/baffles.
3. Fire-suppression systems.
4. Lighting fixtures.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.
1. Shop Drawing Scale: 1/4 inch 1 foot.
2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection si□es, and attachments to other work.
3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
5. Show water-supply and drain piping connections.
6. Show control cabinets.
7. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
8. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and si□e of each field connection.
9. Wiring Diagrams: Power, signal, and control wiring.
10. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression no□□le locations.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

PART 2 - PRODUCTS

2.1 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Minimum Thickness: 0.037 inch.
2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
4. Exposed Surfaces: ASTM A 480/A 480M, No. 4 finish (directional satin).
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.
1. Color: As selected by Architect from manufacturer's full range.
2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

C. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.2 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
5. After □inc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-□inc-dust-content, galvani□ing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food □ones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges si□ed to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

K. Fabricate enclosure panels to ceiling and wall as follows:
1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
2. Wall Offset Spacer: Minimum of 3 inches.
3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch-thick, stainless-steel shelf tops.

2.3 TYPE I EXHAUST HOOD FABRICATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Captive-Aire Systems.
2. Greenheck.
3. LCSystems, Inc.

4. Larcon.

B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
   1. Fabricate hoods according to NSF 2, "Food Equipment."
   2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
   3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
   4. Include access panels as required for access to fire dampers and fusible links.
   5. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch-wide duct flange.

C. Hood Configuration: Exhaust and makeup air.

D. Hood Style: Wall-mounted canopy.

E. The Perforated Supply Plenum (PSP) shall provide make-up air through perforated stainless steel panels. All seams shall be welded and have stainless steel on exposed surfaces. Unexposed surfaces shall be constructed of aluminized steel. Perforated diffuser plates shall be included in the design and to provide even air distribution and the plenum shall be insulated to prevent condensation.

F. Filters/Baffles: Removable, stainless-steel. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

G. Lighting Fixtures: Surface-mounted, incandescent fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.
   1. Light switches shall be mounted on front panel of hood canopy in hood control panel.
   2. Lighting Fixtures: Incandescent complying with UL 1598.

2.4 TYPE II EXHAUST HOOD FABRICATION

A. Fabricate hoods according to NSF 2, "Food Equipment."

B. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible."

C. Hood Configuration: Exhaust only.

D. Hood Type: Condensate removal.

E. Hood Style: Wall-mounted canopy.

F. Condensate Hood Baffles: Removable, stainless-steel baffles to drain into a hood drain trough, and stainless-steel drain piping.

2.5 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

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

1. Ansul Incorporated; a Tyco International Ltd. Company.
2. Badger Fire Protection.
3. Kidde Fire Systems.
4. Pyro Chem.

B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.
1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood or wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

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.

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

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

3.2 INSTALLATION

A. Complete field assembly of hoods where required.
1. Make closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.

B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

E. Install hoods to operate free from vibration.

F. Install seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping with clearance to allow service and maintenance.

C. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

D. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

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

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
4. Perform hood performance tests required by authorities having jurisdiction.
5. Perform fire-suppression system performance tests required by authorities having jurisdiction.

E. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authori□ed service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233813

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SECTION 237333 - INDIRECT-FUEL-FIRED HEATING AND VENTILATING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes indirect-fired H&V units with the following accessories:
   1. Gas furnace.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of indirect-fired H&V units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

A. Coordinate size, location, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

B. Coordinate size, location and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.
   1. Coordinate installation of restrained vibration isolation roof-curb rails, which are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below of indirect-fired H&V units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Captive-Air Systems, Inc.
   2. Aaon.
   3. Greenheck.
   4. LC Systems.
   5. Modine Mfg. Co.; Commercial HVAC&R Division.
   6. Re□nor-Thomas & Betts Corporation; Mechanical Products Division.

2.2 PACKAGED UNITS

A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and indirect-fired gas furnace to be installed outside the building.

2.3 CABINET

A. Cabinet: Double-wall galvani□ed-steel panels, formed to ensure rigidity and supported by galvani□ed-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatheri□ed for outside installation.

B. Access Panels: Piano hinged with cam-lock fasteners for furnace and fan motor assemblies on both sides of unit.

C. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit.
   1. Thickness: 2 inches.
   2. Insulation Adhesive: Comply with ASTM C 916, Type I.
   3. Mechanical Fasteners: Galvani□ed steel suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.

D. Finish: Heat-resistant, baked enamel.

E. Roof Curb: Provide 14” tall roof curb compatible with metal roof system.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.4 SUPPLY-AIR FAN

A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvani□ed steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings.

B. Motor: Open drip proof, single-speed motor.

C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.

D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric isolators.

E. Provide unit with VAV control interlocked with VAV exhaust fan, refer to hood controls section.

2.5 OUTDOOR-AIR INTAKE

A. Outdoor-Air Hood: Galvani□ed steel with rain baffles, bird screen complying with ASHRAE 62.1-2004, and finish to match cabinet; and si□ed to supply maximum 100 percent outdoor air.

2.6 AIR FILTERS

A. Comply with NFPA 90A.

B. Cleanable Filters: 2-inch thick, cleanable metal mesh.

2.7 DAMPERS

A. Outdoor-Air Damper: Galvani□ed-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at differential pressure of 2-inch wg.

B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.8 INDIRECT-FIRED GAS FURNACE

A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and NFPA 54, "National Fuel Gas Code."
   1. AGA Approval: Designed and certified by and bearing label of AGA.
   2. Burners: Stainless steel.
      a. Gas Control Valve: Modulating.
      b. Fuel: Natural gas.
      c. Minimum Combustion Efficiency: 80 percent.
      d. Ignition: Electronically controlled electric spark with flame sensor.
      e. High-Altitude Model: For Project elevation above sea level.

B. Venting: Gravity vented.

C. Power Vent: Integral, motori□ed centrifugal fan interlocked with gas valve.

D. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.

E. Internal Casing: Aluminized steel, arranged to contain airflow, with duct flanges at inlet and outlet.

F. Heat Exchanger: Stainless steel.

G. Heat-Exchanger Drain Pan: Stainless steel.

H. Safety Controls:
1. Vent Flow Verification: Flame rollout switch.
2. Control Transformer: 24-V ac.
3. High Limit: Thermal switch or fuse to stop burner.
4. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, hydraulic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
5. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
6. Gas Manifold: Safety switches and controls to comply with ANSI standards and FMG.
7. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
8. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
9. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

2.9 CONTROLS

A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.

B. Fan Control: Interlock fan to start with exhaust fan(s).

C. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

D. Temperature Control: Operates gas valve to maintain supply-air temperature.
1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
2. Furnace Control: 20 to 100 percent modulation of the firing rate.

E. Provide unit with VAV control interlocked with VAV exhaust fan, refer to hood controls section.

2.10 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

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 installation of indirect-fired H&V units.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where rooftop replacement-air units will be installed.

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

3.2 INSTALLATION

A. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."

B. Install roof curb on roof structure, according to ARI Guideline B. NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure indirect-fired H&V units on curbs, and coordinate roof penetrations and flashing with roof construction.

C. Install controls and equipment shipped by manufacturer for field installation with indirect-fired H&V units.

3.3 CONNECTIONS

A. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.
   1. Gas Piping: Comply with requirements in Division 23 Section "Facility Natural-Gas Piping." Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Provide AGA-approved flexible connectors.

B. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to indirect-fired H&V units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 STARTUP SERVICE

A. Engage a factory-authori□ed service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
   1. Inspect for visible damage to furnace combustion chamber.
   2. Inspect casing insulation for integrity, moisture content, and adhesion.
   3. Verify that clearances have been provided for servicing.
   4. Verify that controls are connected and operable.
   5. Verify that filters are installed.
   6. Purge gas line.
   7. Inspect and adjust vibration isolators.
   8. Verify bearing lubrication.
   9. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   10. Adjust fan belts to proper alignment and tension.
   11. Start unit according to manufacturer's written instructions.
   12. Complete startup sheets and attach copy with Contractor's startup report.
   13. Inspect and record performance of interlocks and protective devices; verify sequences.
   14. Operate unit for run-in period recommended by manufacturer.
   15. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
      a. Gas Burner:
         1) Measure gas pressure at manifold.
         2) Measure combustion-air temperature at inlet to combustion chamber.
         3) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
   16. Calibrate thermostats.
   17. Adjust and inspect high-temperature limits.
   18. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.
   19. Start evaporative cooler system and measure and record the following:
      a. Leaving-air, dry- and wet-bulb temperatures.
      b. Entering-air, dry- and wet-bulb temperatures.
   20. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
   21. Measure and record airflow. Plot fan volumes on fan curve.
   22. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:
      a. High-limit heat.
      b. Alarms.
   23. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace malfunctioning components that do not pass tests and inspections and retest as specified above.

D. Prepare written report of the results of startup services.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

A. Engage a factory-authori□ed service representative to train Owner's maintenance personnel to adjust, operate, and maintain indirect-fired H&V units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237333

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SECTION 237413 – PACKAGED ROOFTOP UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged, outdoor, rooftop units.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

C. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

E. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

F. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

1.5 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. 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.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three 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. Trane.
2. Lennox.
3. Carrier.

2.2 CASING

A. General Fabrication Requirements for Cabinet: Galvani□ed steel, phosphati□ed and finished with and air-dry paint coating with hinged access panels.

B. Hinged and Latched Access Doors: Water and air tight panels with hinges and handles shall be provided to allow access to filters, heating section, supply air fan section, evaporator coil section and unit control section. Must be factory installed.

C. Casing Material: Galvani□ed steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Casing Thickness: 18 gauge structural members and 20 gauge access panels

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1. Thickness: 1/2 inch
2. Insulation materials shall be □ inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air straem
3. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Provide a removable, reversible, cleanable double sloped IAQ drain pan for the base of the evaporator coil constructed of either 303 grade stainless steel or high impact polycarbonate. Drain pan must meet or exceed UL 94B-0/5VA.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

G. Unit base pan shall have a raised 1 1/8 inch high lip around supply and return openings for water integrity

H. Provide opening through the base for power, control, and condensate connections unless otherwise noted in these specifications or contract documents.

I. The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

2.3 FANS

A. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. All three phase motors shall have belt drive motors.

B. Condenser-Coil Fan: Direct drive, propeller type, mounted on shaft of permanently lubricated motor.

C. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 COILS

A. Supply-Air Refrigerant Coil: Configured aluminum fin surface mechanically bonded to copper tubing coil.

B. Condensate Drain Pans: Provide a removable, reversible, cleanable double sloped IAQ drain pan for the base of the evaporator coil constructed of either 303 grade stainless steel or high impact polycarbonate. Drain pan must meet or exceed UL 94B-0/5VA.

C. Expansion Devices: Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 450 psig.

D. Outdoor-Air Refrigerant Coil: Configured aluminum fin surface mechanically bonded to copper tubing coil.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: One.

B. Compressor(s): Scroll compressors with direct drive operating at 3600 RPM. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Air filters: Factory installed filters shall mount integral within in the unit and shall be accessible through hinged access panels. Two-inch thick MERV 7 pleated media filters shall be provided.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. UL or CSA Approval: Designed and certified by and bearing label of UL or CSA.

B. Burners: Alumini□ed steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Tubular section type of alumini□ed steel.

D. Safety 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.

1. Gas Control Valve: Single stage
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

A. Economi□er: Provide each unit with 100% enthalpy economi□er with barometric relief. The assembly includes modulating 0-100 percent motor and dampers, minimum position setting, preset

linkage, wiring harness with plug, spring return actuator and control. The barometric relief shall provide a pressure operated damper that shall be gravity closing and shall prohibit entrance of outside air during the equipment off cycle.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 THERMOSTATS

A. Thermostat: All rooftop units on project shall be controlled with a commercial, touchscreen, wifi, 7-day programmable thermostat equal to Daikin DT4272C.

B. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.
2. Cable Jacket Color: Blue.

C. Controls shall comply with requirements in ASHRAE/IESNA 90.1-2004, "Controls."

2.11 ACCESSORIES

A. Low-ambient with head pressure control for operation down to 0 deg F.

B. Hail guards of galvani□ed steel, painted to match casing.

C. Each rooftop shall be provided with a factory installed and wired phase monitor with LED for on or fault indication. Protection shall be provided against phase imbalance, phase loss, and phase reversal.

D. Hinged access doors.

E. Provide each unit with thru the base electrical connections.

2.12 ROOF CURBS

A. Contractor shall install factory supplied roof curb, 16 gauge perimeter made of □inc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instruction for easy assembly

B. For locker room area units, contractor shall provide and install sloped metal roof curb that is compatible with metal roof and slope of metal roof on this building

C. Curb Height: 14 inches.

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 RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

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

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

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

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237413

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SECTION 238129 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. VRF Indoor Units.
2. VRF Outdoor Heat Recovery Units
3. Heat recovery control units.
4. System controls.
5. System control cable and raceways.

1.3 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all □ones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all □ones in either heating or cooling, but not with simultaneous heating and cooling □ones that transfer heat between □ones.

C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling □ones that transfer heat between □ones.

D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling □ones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

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

F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system

HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

I. VRF: Variable refrigerant flow.

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 indoor and outdoor units and for HRCUs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
6. Include description of control software features.
7. Include refrigerant type and data sheets showing compliance with requirements indicated.
8. For system design software.
9. Indicate location and type of service access.

B. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and si□e of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems 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 CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:

a. One set(s) for each unit with replaceable filters.
b. One set(s) for each unit type and unique size of washable filters.

2. Controllers for Indoor Units: One for each unique controller type installed.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

a. Product research and development.
b. Product and application engineering.
c. Product manufacturing, testing, and quality control.
d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
e. Owner training.

B. Factory-Authori□ed Service Representative Qualifications:

1. Authori□ed representative of, and trained by, VRF HVAC system manufacturer.
2. In-place facility located within 50 miles of Project.
3. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Each person assigned to Project shall have demonstrated past experience.

    a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
    b. Demonstrated past experience on five projects of similar complexity, scope, and value.

D. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

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

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period:

a. For Compressor: 10 year(s) from date of Substantial Completion.
b. For Parts, Including Controls: 10 year(s) from date of Substantial Completion.
c. For Labor: One year(s) 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. Carrier Global Corporation.
2. Daikin Applied.
3. LG.
4. Mitsubishi Electric & Electronics USA, Inc.
5. Trane Inc.
6. Toshiba.

B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. HRCUs.
4. Refrigerant isolation valves.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. Two-pipe or three-pipe system design.
2. System(s) operation, heat pump or heat recovery as indicated on Drawings.

3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

A. Service Access:

1. Provide and document service access requirements.
2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

B. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

C. System Adaptability to Future Changes

1. Future changes to system(s) indicated on Drawings.
2. Each branch circuit shall accommodate addition of two indoor unit(s) with unit capacity equal to average indoor unit connected to the branch circuit.

D. Isolation of Equipment: Provide isolation valves at the ports ff HCRU to isolate each indoor unit for service, removal, and replacement without interrupting system operation.

E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Range acceptable to manufacturer. This is dependent on application and location and manufacturer's representative shall verify.

F. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

G. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.

a. Design equipment and supports to withstand wind loads of governing code.
b. Design equipment and supports to withstand snow and ice loads of governing code.
c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

H. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.

1. Indoor: Within design guidelines of "2015 ASHRAE HANDBOOK- HVAC Applications."
2. Outdoor: Within ordinance of governing authorities.

I. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

J. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: Galvani□ed or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate si□e for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvani□ed, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with bra□ed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.

7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:

1. Fan(s):

   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
   d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 7.
3. Media:

   a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Unit Controls:

1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

   a. Unit inlet air temperature.
   b. Coil entering refrigerant temperature.
   c. Coil leaving refrigerant temperature.

4. Communication: Network communication with other indoor and outdoor units.
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power unit and integral controls.
3. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
4. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Raceways: Enclose line voltage wiring in metal raceways.

2.5 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.

c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted in top or front face of unit cabinet.

H. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Unit inlet air temperature Coil entering refrigerant temperature Coil leaving refrigerant temperature.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification, run test switch.
5. Communication: Network communication with other indoor units and outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
4. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.6 INDOOR, RECESSED, CEILING-MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Internal Tubing: Copper tubing with brazed joints.
6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Bottom, to accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 7.
3. Media:

a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
b. Washable: Manufacturer's standard filter with antimicrobial treatment.

G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.

1. The decoration panel dimensions shall fit into a standard 2x2 ceiling grid with [illegible]. There are still couple manufacturers that do not meet this requirement that are approved to bid and if those are installed on project then it is required for mechanical contractor to coordinate all locations of cassettes with all lights and locate so not overlapping any adjacent lights.

2. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.

a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.
b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.

3. Motori□ed Vanes: Modulating up and down flow pattern for uniform room air distribution.
4. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.

H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.

I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.

J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Connection, motori□ed damper, and control to satisfy unit control sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

K. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Unit inlet air temperature Coil entering refrigerant temperature Coil leaving refrigerant temperature.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification, run test switch.
5. Communication: Network communication with other indoor units and outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.

3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.7 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:

1. Galvani□ed steel and coated with a corrosion-resistant finish.

a. Coating with documented salt spray test performance of 1000 hours according ASTM B117 surface scratch test (SST) procedure.

2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate si□e for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:

a. High refrigerant pressure.
b. Low oil level.
c. High oil temperature.
d. Thermal and overload.
e. Voltage fluctuations.
f. Phase failure and phase reversal.
g. Short cycling.

3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:

    a. Casing: Aluminum, galvanized, or stainless steel.
    b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
    c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:

    a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
    b. Single- or multiple-pass arrangement.
    c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Coating: None.
4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

    a. Direct-drive arrangement.
    b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
    c. Statically and dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

    a. Refrigerant suction temperature.
    b. Refrigerant discharge temperature.
    c. Outdoor air temperature.
    d. Refrigerant high pressure.
    e. Refrigerant low pressure.
    f. Oil level.

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode, night setback control, power consumption display, run test switch equalize run time between multiple same components.
5. Communication: Network communication with indoor units and other outdoor unit(s).

6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
4. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevention corrosion when exposed to salt spray test for 1000 hours according ASTM B117.

J. Unit Piping:

1. Unit Tubing: Copper tubing with bra□ed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.8 HEAT RECOVERY CONTROL UNITS (HRCUs)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:

1. Galvani□ed-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate si□e for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.

2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least two branch circuit port(s) for future use.
4. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.

    a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Communication: Network communication with indoor units and outdoor unit(s).
4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
4. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

G. Unit Piping:

1. Unit Tubing: Copper tubing with bra□ed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.9 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a manufacturer-selected control network.
2. Network Communication Protocol: Manufacturer proprietary or open control communication between interconnected units.

3. Operator Interface:

    a. Operators shall interface with system and unit controls through the following:

        1) Operator interfaces integral to controllers.

2) Owner-furnished PC connected to central controller(s).
3) Web interface through web browser software.
4) Integration with Building Automation System.

b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

1) On/off control.
2) Temperature set-point adjustment.

B. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimi□ed start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Multiple Languages: English or Spanish.
10. Supports Imperial and Metric Temperature Units: Fahrenheit or Celsius.
11. Displays service notifications and error codes.
12. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
13. Monitors and displays cumulative operating time of indoor units.
14. Able to disable and enable operation of individual controllers for indoor units.
15. Information displayed on individual controllers shall also be available for display.
16. Information displayed for outdoor units, including refrigerant high and low pressures.

C. Central Controllers:

1. Centrali□ed control for all indoor and outdoor units from a single central controller location.

a. Include multiple interconnected controllers as required.

2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

a. Sets schedule for daily, weekly, and annual events.
b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimi□ed start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.

D. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English or Spanish.
4. Temperature Units: Fahrenheit or Celsius.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Service Notification Display: "Filter".
17. Service Run Tests: Limit use by service personnel to troubleshoot operation.
18. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
19. User and Service Passwords: Capable of preventing adjustments by unauthori□ed users.
20. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
21. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.10 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.

2. ASHRAE 34, Class A1 refrigerant classification.
3. R-410a.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.11 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

C. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on si□e.

2.12 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

a. Flame Travel Distance: 60 inches or less.
b. Peak Optical Smoke Density: 0.5 or less.
c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

a. Type as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

a. Type as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: Comply with NFPA 262.

C. TIA-485A Network Cabling:

1. Standard Cable: NFPA 70, Type CMG.

a. Type as required by VRF HVAC system manufacturer.
b. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated Cable: NFPA 70, Type CMP.

a. Type as required by VRF HVAC system manufacturer.
b. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
c. Flame Resistance: NFPA 262.

D. Ethernet Network Cabling: TIA-568-C.2 Category 6 cable with RJ-45 connectors.

1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Shielding: Shielded twisted pairs (FTP).
4. Cable Rating: By application.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.13 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

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 products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.

D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.

E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.

F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.

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

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

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by manufacturer's service representative or system Installer under supervision of manufacturer's service representative.

C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

I. Install floor-mounted units on support structure indicated on Drawings.

J. Install floor-mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

K. Attachment: Install hardware for proper attachment to supported equipment.

L. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Install outdoor units on support structures indicated on Drawings.

C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Grouting: Place grout under equipment supports and make bearing surface smooth.

D. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install hard piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Install soft piping and tubing with a long swooping radius trying to avoid sharp right angles and keeping close to parallel to building walls.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.
    c. Governing codes.
    d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than two percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.7 INSTALLATION OF REFRIGERANT PIPING

A. Install refrigerant piping according to ASHRAE 15 and governing codes.

B. Select system components with pressure rating equal to or greater than system operating pressure.

C. Install piping as short and direct as possible, with a minimum number of joints and fittings.

D. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

E. Install refrigerant piping and tubing in protective conduit where installed belowground.

F. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

G. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

H. When brazing, remove or protect components that could be damaged by heat.

I. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

J. Joint Construction:

1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

    a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
    b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.8 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for nonmetal ducts specified in Section 233116 "Nonmetal Ducts."

D. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

E. Comply with requirements for flexible ducts specified in Section 233346 "Flexible Ducts."

F. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."

G. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

3.9 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

E. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections.

F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
2. Locate nameplate or label where easily visible.

G. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Outlet boxes for cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring si□ed to bring edge of ring to within 1/8 inch of the finished wall surface.
3. Flexible metal conduit shall not be used.

H. Comply with TIA-569-D for pull-box si□ing and length of conduit and number of bends between pull points.

I. Install manufactured conduit sweeps and long-radius elbows if possible.

J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.10 SOFTWARE

A. Cybersecurity:

1. Software:

a. Coordinate security requirements with IT department.
b. Ensure that latest stable software release is installed and properly operating.
c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.

2. Hardware:

a. Coordinate location and access requirements with IT department.
b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
c. Disable dual network connections.

3.11 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

a. Within equipment and associated control enclosures.
b. In accessible ceiling spaces where open cable installation method may be used. Where possible, it is acceptable to install the VRF system control wiring directly strapped to the VRF refrigerant piping from indoor unit to heat recovery control unit for ease of tracing of wiring
c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
3. Where possible, it is acceptable to install the VRF system control wiring directly strapped to the VRF refrigerant piping from indoor unit to heat recovery control unit for ease of tracing of wiring.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.12 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.13 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.14 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."

B. Identify system electrical and controls components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.15 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by a factory-trained and -authori□ed service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

a. Additional factory-authori□ed representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authori□ed representative shall not provide assistance without manufacturer's employee supervision.

2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.

a. First Visit: Kick-off meeting.
b. Second Visit: At approximately 50 percent completion of system(s).
c. Third Visit: At approximately 95 percent completion of system(s).
d. Fourth Visit: Final inspection before system startup.

3. Kick-off Meeting:

a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
c. Meeting shall cover the following as a minimum requirement:

1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
2) Manufacturer's installation requirements specific to systems being installed.
3) Review of all relevant VRF HVAC system submittals, including delegated-design submittals.
4) Required field activities related installation of VRF HVAC system.
5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.

4. Site Visits: Activities for each site visit shall include the following:

    a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
    b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
    c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
    d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
    e. Issue a report for each visit, documenting the visit.

        1) Report to include name and contact information of individual making the visit.
        2) Date(s) and time frames while on-site.
        3) Names and contact information of people meeting with while on-site.
        4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

5. Final Inspection before Startup:

    a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
    b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
    c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
    d. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
    e. Installer shall correct observed deficiencies found by the inspection.
    f. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.
    g. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
    h. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energi□ed, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.16 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be a factory-trained and -authori□ed service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.

a. All available system operating parameters shall be included in the information submitted.

E. Witness:

1. Invite Owner and Commissioning Agent to witness startup service procedures.
2. Provide written notice not less than 20 business days before start of startup service.

3.17 ADJUSTING

A. Adjust equipment and components to function smoothly and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.18 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.19 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of system Installer. Include four service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.20 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.

3.21 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:

1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
2. Instructor's credentials shall be submitted for review by Architect before scheduling training.

3. Instructor(s) primary job responsibility shall be Owner training.
4. Instructor(s) shall have not less than three years of training experience with VRF HVAC system manufacturer and past training experience on at least three projects of comparable size and complexity.

C. Schedule and Duration:

1. Schedule training with Owner at least 20 business days before first training session.
2. Training shall occur before Owner occupancy.
3. Training shall be held at mutually agreed date and time during normal business hours.
4. Each training day shall not exceed eight hours of training. Daily training schedule shall allow time for one-hour lunch period and 15-minute break after every two hours of training.
5. Perform not less than eight total hours of training.

D. Location: Owner shall provide a suitable on-site location to host classroom training.

E. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

F. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

G. Training Materials: Provide training materials in electronic format to each attendee.

1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.

H. Acceptance: Obtain Architect written acceptance that training is complete and requirements indicated have been satisfied.

END OF SECTION 238129

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SECTION 260410 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Existing Conditions Division 02 Specification sections, apply to the work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Abandoned Circuits: Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Field Conditions: Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner and Architect/Engineer before disturbing existing installation.

D. Existing Conditions: Beginning of demolition means installer accepts existing conditions.

3.2 REPARATION

A. Demolition: Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Utility Coordination: Coordinate utility service outages with Utility Company.

C. Temporary Wiring: Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energi□ed equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Minimi□e outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimi□e outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service new system is accepted. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 72 hours before partially or completely disabling system. Minimi□e outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. General: Demolish and extend existing electrical work under provisions of the Drawings, General Provisions of the Contract, including General and Supplementary Conditions and Existing Conditions Division 02 Specification sections.

B. New Construction: Remove, relocate, and extend existing installations to accommodate new construction.

C. Abandoned Wiring: Remove abandoned wiring to source of supply.

D. Exposed Conduit: Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Abandoned Devices: Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets, which are not removed.

F. Abandoned Panelboards: Disconnect and remove abandoned panelboards and distribution equipment.

G. Abandoned Equipment: Disconnect and remove electrical devices and equipment serving utili□ation equipment that has been removed.

H. Abandoned Lighting Fixtures: Disconnect and remove abandoned lighting fixtures. Remove brackets, stems, hangers, and other accessories.

I. Adjacent Construction: Repair adjacent construction and finishes damaged during demolition and extension work.

J. Existing wiring to remain active: Maintain access to existing electrical installations, which remain active. Modify installation or provide access panel as appropriate.

K. Extension of existing wiring: Extend existing installations using materials and methods compatible with existing electrical installations, as specified.

3.4 CLEANING AND REPAIR

A. Existing Materials: Clean and repair existing materials and equipment that remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Lighting Fixtures: Remove existing lighting fixtures for cleaning. Use mild detergent to clean all exterior and interior surfaces, rinse with clean water and wipe dry. Replace lamps and broken electrical parts.

D. Ballasts: Replace the ballasts in all existing lighting fixtures with new ballasts as specified under Section 290923 - LIGHTING.

3.5 INSTALLATION

A. Relocated Materials: Install relocated materials and equipment under the provisions of Division 1 of the Specifications.

END OF SECTION 16060

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SECTION 260510 - COMMON WORK RESULTS FOR ELECTRICAL

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. Section Includes:

1. General requirements.
2. Electrical equipment coordination and installation.
3. Sleeves for raceways and cables.
4. Sleeve seals.
5. Grout.
6. Common electrical installation requirements.

1.3 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. Connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

1.4 GENERAL REQUIREMENTS

A. In general, the electrical lines to be installed under these Specifications shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards as to complete the work in a neat and satisfactorily workable manner. The following is a general outline concerning the running of electrical lines

and is to be excepted where the drawings or conditions at the building necessitate deviating from these standards.

B. The Contractor shall thoroughly acquaint himself with the details of the construction and finishes before submitting his bid as no allowances will be made because of the Contractor's unfamiliarity with these details. Place all inserts in masonry walls while they are under construction. All concealed lines shall be installed as required by the pace of the general construction to precede that general construction.

C. The electrical Drawings do not give exact details as to elevations of electrical lines, exact locations, etc., and do not show all the offsets, and other installation details. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to avoid all obstruction, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and thereby to provide an integrated, satisfactorily operating installation.

D. The electrical Drawings show diagrammatically the locations of the various electrical outlets and apparatus and the method of circuiting and controlling them. Exact locations of these outlets and apparatus shall be determined by reference to the general Drawings and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with other sections, and in all cases shall be subject to the approval of the Architect. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation (within 10 feet of location shown on drawings) or after installation if an obvious conflict exists, without additional cost to the Owner.

E. The Contractor shall be responsible for the proper fitting of his material and apparatus into the space. Should the particular equipment that any bidder proposes to install require other space conditions than those indicated on the drawings, he shall arrange for such space with the Architect before submitting his bid. Should changes become necessary on account of failure to comply with this clause, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

F. The contractor for the work under each section of these specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

G. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Architect, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

H. The Contractor shall submit working scale drawings of all his apparatus and equipment which in any way varies from these specifications and plans. The drawings shall be checked by the Architect before the work is started. Any conflict with the building conditions shall be corrected by the Contractor before the work proceeds.

I. Order of precedence shall be observed in laying out the pipe, ductwork, material, and conduit in order to fit the material into the space above the ceiling and in the chases and walls. The following order shall govern:

1. Items affecting the visual appearance of the inside of the building such as lighting fixtures, diffusers, grilles, outlets, panelboards, etc. Coordinate all items to avoid conflicts at the site.
2. Lines requiring grade to function such as sewers, roof drains and condensate drains.
3. Large ducts and pipes with critical clearances.
4. Conduit, water lines, and other lines whose routing is not critical and whose function would not be impaired by bends and offsets.

J. Conduits serving outlets on items of equipment shall be run in the most appropriate manner. Where the equipment has built-in chases, the lines shall be contained therein. Where the equipment is of the open type, the lines shall be run as close as possible to the underside of the top and in a neat and inconspicuous manner.

K. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through windows, doorways or shafts, shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed.

L. Exceptions and inconsistencies in Drawings and Specifications shall be brought to the Architect's attention before the contract is signed. Otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus, material, or equipment.

M. The Contractor shall distinctly understand that the work described herein and shown on the accompanying drawings shall result in a finished and working job, and any item required to accomplish this intent shall be included whether specifically mentioned or not.

N. Each bidder shall examine the Drawings and Specifications for the General Construction. If these documents show any item requiring work under Division 26 and that work is not indicated on the respective Electrical drawings, he shall notify the Architect in sufficient time to clarify before bidding. If no notification is received, the Contractor is assumed to require no clarification, and shall install the work as indicated on the General Drawings in accordance with the Specifications.

O. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings. Any difference which may be found shall be submitted to the Architect for consideration before proceeding with the work.

P. The accompanying plans do not indicate completely the existing electrical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

Q. There are portions of the existing electrical System that shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations, which must be relocated to avoid interference with the installations of new work of his particular trade and that of all other trades. All such existing installations that interfere with new installations shall be relocated by the Contractor under the Division in which the existing material normally belongs, and in a manner as directed by the Architect. For example where existing conduit and electrical equipment interferes with the installation of new work; it shall be relocated under Division 16.

Failure to become familiar with the extent of the relocation work involved shall not relieve the Contractor of responsibility and shall not be used as a basis for additional compensation.

R. All electric wiring of every character, both for power supply, for pilot and control, for temperature control, for communications, etc. will be done under Division 16 of these Specifications. Every electrical current consuming device furnished as a part of this project, or furnished by the Owner and installed in this project, shall be completely wired up under Division 26. Verification of exact location, method of connection, number and size of wires required, voltage requirements, and phase requirements is the responsibility of the Contractor under Division 26. If conflicts occur between the drawings and the actual requirements, actual requirements shall govern.

S. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer.

T. The workmanship shall in all respects be of the highest grade and all construction shall be done according to the best practice of the trade.

U. The shop drawings for all equipment are hereby made a part of these Specifications. The Contractor under each section of the Specifications shall rough-in for the exact item to be furnished on the job, whether in another section of the Specifications or by the Owner. The Contractor shall refer to all drawings and other sections of the Specifications for the scope of work involved for the new equipment, and by actual site examination determine the scope of the required equipment connections for the Owner furnished equipment.

V. Should any of the equipment furnished require connections of a nature different from that shown on the drawings, report the matter to the Architect and finally connect as directed by the Architect. Minor differences in the equipment furnished and that indicated on the drawings will not constitute ground for additional payment to the Contractor.

1.5 MATERIALS

A. All materials shall be new unless otherwise specified and of the quality specified. Materials shall be free from defects and undamaged. All materials of a type for which the Underwriters Laboratories, Inc. have established a standard shall be listed by the Underwriters Laboratories, Inc. and shall bear their label.

B. The Architect reserves the right to call for samples of any item of material offered in substitution, together with a sample of the specified material, when, in the Architect's opinion, the quality of the material and/or the appearance is involved and it is deemed that an evaluation of the two materials may be better made by visual inspection. This shall be limited to lighting fixtures, wiring devices, and similar items and shall not be applicable to major manufacturers' items of equipment.

C. The Contractor shall be responsible for transportation of his materials to and on the job, and shall be responsible for the storage and protection of these materials and work until the final acceptance of the job.

D. The Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds, and all labor required for the safe and expeditious execution of his contract.

1.6 SUBMITTALS

A. Wherever shop drawings/submittals are called for in these specifications, they shall be furnished by the Contractor for the work involved after review by the Architect as to the make and type of material and in sufficient time so that no delay or changes will be caused. This is done in order to facilitate progress on the job and failure on the part of the Contractor to comply shall render him liable to stand the expense of any and all delays, changes in construction, etc., occasioned by his failure to provide the necessary details. Also, if the Contractor fails to comply with this provision, the Architect reserves the right to go directly to the manufacturer he selects and secure any details he might deem necessary and should there be any charges in connection with this, they shall be borne by the Contractor.

B. Shop drawings will be reviewed by the Architect for general compliance with the design concept of the project and general compliance with the information given in the contract documents. Review by the Architect and any action by the Architect in marking shop drawings is subject to the requirements of the entire contract documents. Contractor will be held responsible for quantities, dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of all trades and the satisfactory performance of his work.

C. Shop drawings submitted shall not consist of manufacturers' catalogues or tear sheets therefrom that contain no indication of the exact item offered. Rather, the submission of individual items shall designate the exact item offered and shall clearly identify the item with the project.

D. All shop drawings shall be submitted at one time and shall consist of a bound catalogue of all shop drawings under each section, properly indexed and certified that they have been checked by the Contractor.

E. The omissions of any material from the shop drawings which has been shown on the contract drawings or specified, even though reviewed by the Architect, shall not relieve the Contractor from furnishing and erecting same.

1.7 PERMITS, FEES, ETC.

A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall arrange for all utility services, including sewer, water and gas services as applicable. If any charges are made by any of the utility companies due to the work on this project, the Contractor shall pay these charges, including charges for metering, connection, street cutting, etc. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.8 LAWS, CODES, AND ORDINANCES

A. All work shall be executed in strict accordance with all local, state and national codes, ordinances and regulations governing the particular class of work involved, as interpreted by the inspecting authority. The Contractor shall be responsible for the final execution of the work under this heading to suit those requirements. Where these specifications and the accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect, shall prepare any supplemental drawings required illustrating how the work may be installed so as to comply and, on approval, make the changes at no cost to the Owner. On completion of the various portions of the work the installation shall be tested by the constituted

authorities, approved and, on completion of the work, the Contractor shall obtain and deliver to the Owner a final certificate of acceptance.

1.9 TESTING

A. The Contractor under each division shall at his own expense perform the various tests as specified and required by the Architect and as required by the State and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests. Notify the Architect a minimum of 24 hours in advance of all tests.

1.10 COORDINATION OF TRADES

A. The Contractor shall be responsible for resolving all coordination required between trades. For example, items furnished under Division 23 which require electrical connections shall be coordinated with Division 26 for:
1. Voltage
2. Phase
3. Ampacity
4. No. and size of wires
5. Wiring diagrams
6. Starter size, details and location
7. Control devices and details

B. Items furnished under various sections which require electrical connections shall be coordinated for services, voltage, size and location of connections.

C. Items requiring insulation shall be fully insulated and that insulation shall be checked against manufacturer's directions and job requirements for suitability, coverage, thickness and finish.

D. Items installed in/on finished ceilings shall be coordinated with the ceiling construction. The Contractor under each section shall conform to the reflected ceiling plan and shall secure details and/or samples of the ceiling materials as necessary to insure compatibility. Any device not conforming to this requirement shall be replaced by the Contractor at his expense.

E. All items specified under Division 26 shall be installed tight, plumb, level, square and symmetrically placed in relation to the work of other trades.

1.11 CUTTING AND PATCHING

A. All cutting and patching for work under Division 23 shall be done by the Contractor under the section for which the trade is specified.

1.12 CUTTING AND PATCHING

A. The Contractor for work specified under each section shall perform all structural and general construction modifications and cut all openings through either roof, walls, floors or ceilings required to install all work specified under that section or to repair any defects that appear up to the expiration of the guarantee. The Contractor shall exercise due diligence to avoid cutting openings larger than required or in wrong locations. Verify the scope of this work at the site and in cooperation with all other trades before bidding.

B. No cutting shall be done to any of the structural members that would tend to lessen their strength, unless specific permission is granted by the Architect to do such cutting.

C. The Contractor for work under each section shall be responsible for the patching of all openings cut to install the work covered by that section and to repair the damage resulting from the failure of any part of the work installed hereunder.

D. Before bidding, the Contractor shall review and coordinate the cutting and patching required under the respective section with all trades.

E. In all spaces where new work under Division 23 is installed and no other alteration or refinishing work is shown or called for, existing floors, walls and ceilings shall be restored to match existing conditions. All cutting and patching shall be done by workmen skilled in the affected trade.

F. Where openings are cut through masonry walls, the Contractor under each respective section shall provide and install lintels or other structural supports to protect the remaining masonry and adequate support shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation.

1.13 QUALITY ASSURANCE

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

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

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

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

1.14 SUBSTITUTIONS

A. Where a definite material or only one manufacturer's name is mentioned in these specifications, it has been done in order to establish a standard. The product of the particular manufacturer mentioned is of satisfactory construction and any substitution must be of quality as good as or better than the named article. No substitution shall be made without review by the Architect, who will be the sole judge of equality.

B. The Contractor shall submit for approval a complete list of the materials he proposes to use. This list shall give manufacturers' names and designations corresponding to each and every item and the submission shall be accompanied by complete descriptive literature and/or any supplementary data, drawings, etc., necessary to give full and complete details.

C. Should a substitution be accepted under the provisions of the conditions of these specifications, and should this substitute prove to be defective or otherwise unsatisfactory for the service for which it is intended within the guarantee period, the Contractor who originally requested the substitution shall replace the substitute material with the specified material.

1.15 TEMPORARY POWER AND LIGHTING

A. Engage the appropriate local utility company to install temporary service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

B. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

C. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

D. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.

E. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.

F. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear. All temporary power for construction will be provided by Contractor. Owner will pay bills when submitted for payment.

G. Install electric power service underground, except where overhead service must be used.

H. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, power wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance. All circuits must be ground-fault circuit interrupter protected.

I. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment. Provide four gang outlets, spaced so 100 foot cords can reach any areas. Provide separate 120 VAC, 20 amp GFCI circuit for each four gang outlet.

J. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

K. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching:

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

L. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

M. Provide three 100-W incandescent lamps per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.

N. Provide two 100-W incandescent lamps every 50 feet (15 m) in traffic areas.

O. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the work is being performed.

1.16 USE OF SYSTEMS

A. It is considered that it will be necessary to operate the mechanical systems to provide heating and ventilation in portions of the building that are enclosed. As systems or portions of systems become operable, they shall be operated as required to maintain habitable conditions in enclosed portions of the building that are still under construction and portions that are fully complete as may be required to properly protect installed piping, equipment and finishes.

B. In order to provide protection to ducts, plenums, etc. install temporary filters over or in return air openings until all finished painting is completed. Protect supply outlets, coils, etc. as necessary in each case.

C. Except for operation of cooling equipment to prove its performance and to adjust and balance the systems, that equipment will not be operated for comfort of construction workers.

D. During warm weather the Contractor shall arrange for the operation of systems to supply 100 percent outside air. The systems controls shall be reset to their normal cycle of operation in each case during the times that heating is required and when the cooling equipment is operated.

E. Immediately prior to the time that the systems are to be accepted by the Owner, each system shall be carefully examined and if ductwork is dirty, it shall be carefully cleaned by men skilled in that type of work. All filters shall be put in first class condition by replacement of filters and/or other procedures as directed.

F. The use of the equipment for maintaining environmental and/or protective temperature conditions shall in no way constitute acceptance of that equipment and the connected piping, ducts, insulation, finishes, etc. by the Owner. Furthermore, it shall in no way shorten the guarantee period hereinafter specified. The Contractor shall either secure extended warranties from the vendors of equipment or shall purchase insurance to provide proper coverage on the equipment through the guarantee period and shall file with the Architect substantiating affidavits from equipment manufacturers or a copy of the insurance policy covering the equipment through the guarantee period. The personal underwriting of the Contractor for equipment manufacturers' warranties is not acceptable, but his personal underwriting of piping, ductwork, insulation and associated materials is acceptable subject to the provisions of the contract.

G. The Contractor shall provide such labor as may be required in the operation of the systems and shall pay all costs.

1.17 INSTALLATION DRAWINGS

A. It shall be incumbent upon the Contractor to prepare special drawings as called for elsewhere herein or as directed by the Architect to coordinate the work under each section, to illustrate changes in his work, to facilitate its concealment in finished spaces to avoid obstructions or to illustrate the adaptability of any item of equipment which he proposes to use.

B. These drawings shall be used in the field for the actual installation of the work. Unless otherwise directed, they shall not be submitted for approval but three copies shall be provided to the Architect for his information.

1.18 OPERATING INSTRUCTIONS

A. The Contractor for each section of the work hereunder shall, in cooperation with the representatives of the manufacturers of the various equipment items, carefully instruct the Owner's representatives in the proper operation of each item of equipment and of each system. During the balancing and adjusting of systems, the Owner's representative shall be made familiar with all procedures.

1.19 OPERATING MANUALS

A. Prepare and submit 3 copies of the operating manuals bound in hard covers. Three weeks prior to completion of the work, the Architect will check the manuals and any additional material necessary to complete the manuals shall be furnished and inserted by the Contractor.

B. Manuals shall contain the following data:

1. Catalogue data of all equipment.
2. Shop drawings of all equipment.
3. Panel schedules.
4. Start-up instructions for major equipment.
5. Trouble shooting procedures for major equipment.
6. Wiring diagrams.
7. Recommended maintenance schedule for equipment.
8. Parts list for all items.
9. Name and address of each vendor.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvani□ed steel, plain ends.

B. Sleeves for Rectangular Openings: Galvani□ed sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. 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.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 LOCATION AND DETECTION

A. Below ground:

1. Non-Metallic: Non-metallic pipe installed below ground shall have installed in the same trench a detectable plastic tape that conforms in to the APWA color coding as follows:
   a. Orange – Telecommunications
   b. Blue – Water
   c. Green – Sanitary and Sewer Systems
   d. Yellow – Gas
2. Such tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be approved 2 1/8" wide and shall be imprinted with a continuous traceable for a minimum of eight years after direct burial. Product shall be Terra Tape Detectable or approved equal. Tape shall be installed per manufacturer's instructions, but no less than 12" above the buried line.
3. Provide 16 gauge direct burial tracer wire with all non-metallic underground pipe. Wire shall be single strand, 14 gauge minimum with 4/64" vinyl insulation which is UL

approved for direct underground burial when used in a National Electric Code Class II circuit.

B. Metallic:
1. Below ground metallic piping shall have identifying tape similar to that specified for below ground non-metallic except that the aluminum foil for location is not required.

3.4 PAINTING

A. If the factory finish on any apparatus or equipment is marred, it shall be touched up and then given one coat of half-flat-half-enamel, followed by a coat of machinery enamel of a color to match the original. Paint factory primed surfaces.

B. Paint all exposed conduit, boxes, cabinets, hangers and supports, and miscellaneous metal.

C. Generally, painting is required on all surfaces such that no exposed bare metal is visible.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION 260510

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire for light fixtures only.

2.2 CONNECTORS AND SPLICES

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

K. Class 1 Control Circuits: Type THHN-THWN, in raceway.

L. Class 2 Control Circuits: Type THHN-THWN, in raceway.

M. All fire alarm wiring shall be in raceway, minimum size ¾". Voice/Data, thermostat, lighting control wiring: Extend conduit to an accessible point above ceiling. In areas with exposed ceilings/structure route low-voltage/control wiring in conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.3 SUBMITTALS

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

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Ground rods.
2. Grounding arrangements and connections for separately derived systems.
3. Grounding for sensitive electronic equipment.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, ¼" by 4" inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, si□es, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, si□ed for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to hori□ontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a ¼" – by – 4" – by -12"-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equali□er and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energi□ed, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 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. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. Thomas & Betts Corporation.
e. Unistrut; Tyco International, Ltd.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, □inc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.
8. Roof Mounted conduit use MAPA products conduit support systems.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Si□e for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod si□e shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trape□e-type supports fabricated with steel slotted support system, si□ed so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trape□e supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
9. Roof Mounted conduit use MAPA products conduit support systems.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. LFMC: Liquid-tight flexible metal conduit.

C. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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:

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

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Electri-Flex Co.

3. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. EMT: ANSI C80.3.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: compression type.

G. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

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

1. CANTEX Inc.
2. Electri-Flex Co.
3. Carlon Electrical Products.
4. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

2.4 BOXES, ENCLOSURES, AND CABINETS

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

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Hoffman.
3. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
4. RACO; a Hubbell Company.
5. Thomas & Betts Corporation.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F [illegible] **AS** [illegible]

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.6 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC (Sealtite).
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechani□ed carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Si□e: 3/4-inch trade si□e.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from Type EPC-40-PVC, or rigid steel conduit before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit conduit (minumum 36” deep). Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit hori□ontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvani□ed finishes with □inc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

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

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material shall be polyethylene and not less than 6 inches wide and 4 mils thick and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
4. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger si□es.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 EQUIPMENT IDENTIFICATION LABELS

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

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. Plenum-Rated Cable Ties: Self extinguishing, UV stabili□ed, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

H. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl tape applied bands:

1. Fire Alarm systems: Red.
2. Security System: Blue and yellow.
3. Telecommunications System: Green and yellow.
4. Control wiring: Green and red.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 10 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.

b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase si□es of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.

v. UPS equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

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. Photoelectric switches.
   2. Standalone daylight-harvesting switching controls.
   3. Indoor occupancy sensors.
   4. Lighting contactors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

   1. Interconnection diagrams showing field-installed wiring.
   2. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Intermatic Inc.
   2. Novitas, Inc
   3. Square D; Schneider Electric.
   4. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
   3. Time Delay: Fifteen second minimum, to prevent false operation.

4. Surge Protection: Metal-oxide varistor, comply with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Lutron Electronics Co., Inc. or approved equal

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
   3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

   1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
   2. Sensing Technology: Dual technology - PIR and ultrasonic.
   3. Switch Type: SP
   4. Voltage: 120 or 277 V type.
   5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
   6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
   7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
   8. Adaptive Technology: Self-adjusting circuitry detects and memori□es usage patterns of the space and helps eliminate false "off" switching.

2.3 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

   1. Square D; a brand of Schneider Electric.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
   3. Eaton Corporation.

B. Description: Electrically operated and electrically held, combination-type lighting contactors complying with NEMA ICS 2 and UL 508.

   1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
   2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
   3. Enclosure: Comply with NEMA 250.

2.4 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262413 - SWITCHBOARDS

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. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Accessory components and features.
6. Identification.

1.3 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.6 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's written permission.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

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

B.

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

C. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

D. Indoor Enclosures: Steel, NEMA 250, Type 1.

E. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

F. Outdoor Enclosures: Type 4 Lockable Enclosure.

G. Barriers: Between adjacent switchboard sections.

H. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

I. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

J. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws, for access to rear interior of switchboard.

K. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

L. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

M. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, Copper feeder circuit-breaker line connections.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: Hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

N. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

O. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

P. Panel and circuit breakers shall be “Fully rated”. Series rated equipment is not acceptable.

Q. Arc Flash calculations and labeling shall be provided by equipment manufacturer.

2.2 OVERCURRENT PROTECTIVE DEVICES

A. Group mounted circuit breakers through 1200A.

B. Electronic trip molded/insulated case full function 100% rated circuit breaker(s) through 1200A.

C. All electronic circuit breakers shall have the following time/current response adjustments:
   1. Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.

D. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13^{th}) harmonic. Provide with Micrologic Ammeter Trip Unit or approved equal.

E. Local visual trip indication for overload, short circuit and ground fault trip occurrences.

F. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.

G. Provide Coordination study for trip settings of all circuit breakers. Circuit breaker coordination/settings shall be provided by manufacturer.

H. Provide power meter on incoming feeders equal to Square D Power logic PM820 or approved equal.

I. Provide integral mounted Surge Protection Device(SPD). The SPD shall have a minimum surge current rating of 240KA per phase and be provided with an audible alarm and surge counter. The SPD shall have a minimum warranty of 10 years.

J. GFI protection for all circuit breakers 1000A or larger for 480/277 volt power systems as required NEC.

K. Provide energy reduction maintenance switch as indicated in NEC.

2.3 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

   1. Nameplate: At least 0.032-inch-thick anodi□ed aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

C. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

D. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated in coordination study.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262413

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SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

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

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's and Owner's written permission.
3. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces.

Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

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

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor. Only provide for surface mounted panels in finished spaces not in electrical or mechanical rooms.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.

7. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

H. Panel and circuit breakers shall be “Fully rated”. Series rated equipment is not acceptable.

I. Arc Flash calculations and labeling shall be provided by equipment manufacturer.

2.2 DISTRIBUTION PANELBOARDS

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

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Circuit breaker coordination/settings shall be provided by manufacturer.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
4. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration. Provide AFCI circuit breakers in all areas required by NEC article 210.12.
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
g. Circuit breaker coordination/settings shall be provided by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated in coordination study.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Receptacles with integral surge suppression units.
3. Isolated-ground receptacles.
4. Snap switches and wall-box dimmers.
5. Pendant cord-connector devices.
6. Cord and plug sets.
7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).
3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; PRO5352
Or Approved Equal

2.3 USB RECEPTACLES

A. General Description: Straight blade, non-feed-through type with two(2) Type 2.0 USB ports. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles with two(2) Type 2.0 USB ports, 125 V, 20 A: Comply with UL 498 Supplement SD.
2. Products: Subject to compliance with requirements, provide one of the following:
a. Hubbell; USB20X2W.
b. Or Approved Equal

2.4 TAMPER RESISTANT RECEPTACLES

A. Duplex Convenience Receptacles, 125 V, 20 A with tamper resistant internal mechanisms to limit access to energi□ed internal components. Provide tamper resistant receptacles in school area as required by NEC.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; PRO5352TR
b. Or Approved Equal

2.5 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GF20LA.
b. Or Approved Equal

2.6 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
b. Or approved equal.

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HPL1221PL for 120 V and 277 V.
a. Or approved equal.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1221L.
a. Or approved equal.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1557.
b. Or approved equal.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1557L.
b. Or approved equal.

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: 0.035-inch-thick, satin-finished stainless steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.9 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pig-tailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.3 DEFINITIONS

A. HD: Heavy duty.

B. NC: Normally closed.

C. NO: Normally open.

D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's written permission.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Auxiliary contacts, arranged to activate before switch blades open.

2.2 NONFUSIBLE SWITCHES

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

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary contacts, arranged to activate before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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

1. Square D; a brand of Schneider Electric.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame si□es 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Coordination Study.

END OF SECTION 262816

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SECTION 262913 - ENCLOSED CONTROLLERS

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 the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.

f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.

D. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

F. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

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

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical systems without Architect's and Owner's written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate si□es and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers:
   a. Square D; a brand of Schneider Electric.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. Rockwell Automation, Inc.; Allen-Bradley brand.
   d. Cutler-Hammer

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Overload Relays: NEMA ICS 2, melting alloy type.
2. Mounting: Surface

2.3 Magnetic Controllers: Full voltage, across the line, electrically held.

1. Configuration Non-reversing.
2. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
4. Control Circuits: Coordinate control voltage with system.

5. Solid-State Overload Relay:

    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    d. Analog communication module.
    e. Electronic type; with phase loss and unbalance protection.
    f. External overload reset push button.

D. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

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

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Division 26 Section "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test continuity of each circuit.

B. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test continuity of each circuit.
3. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages.
4. Test each motor for proper phase rotation.
5. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Enclosed controllers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required

END OF SECTION 262913

SECTION 275123 - EDUCATIONAL INTERCOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes microprocessor-switched intercommunications and program systems with the following components:

1. Administrative console.
2. Call control console.
3. Staff telephone stations.
4. Speaker-microphone stations.
5. Call-switch unit.
6. All-call amplifier.
7. Intercommunication amplifier.
8. Paging amplifier.
9. Loudspeakers/speaker microphones.
10. Conductors and cables.
11. Raceways.
12. Local Area Network (LAN): Dedicated new system.

1.3 DEFINITIONS

A. DHCP: Dynamic Host Configuration Protocol.

B. FXO: Foreign eXchange Office.

C. H.323: Audio and Video Protocol.

D. SIP: Session Initiation Protocol.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For educational intercommunications and program systems.

1. Include plans, elevations, sections, and □□□□□□□ □□□details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and si□e of each field connection.
3. Include scaled drawings for administrative console and speaker-microphone station statin arrangement of built-in equipment.

4. Include diagrams for power, signal, and control wiring.

    a. Identify terminals to facilitate installation, operation, and maintenance.
    b. Single-line diagram showing interconnection of components.
    c. Cabling diagram showing cable routing.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including luminaires, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.
2. Elevation drawings, drawn to scale, on which wall-mounted items including luminaires, intercommunications components, windows, doors, access panels, wall finishes, trims, piping, and conduit are shown and coordinated with each other, using input from Installers of the items involved.

B. Qualification Data: For Installer.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For educational intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. A record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
2. A record of Owner's equipment-programming option decisions.
3. Plans, drawn to scale, indicating location, designation, and connection of intercommunications system components.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authori□ed representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.

1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems □□□□ Technician.

1.8 COORDINATION

A. Coordinate layout and installation of ceiling-mounted speaker microphones and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bogen

B. Rauland

C. Or approved equal.

2.2 SYSTEM DESCRIPTION

A. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 H□ in a satisfactory manner without the requirement of any external power conditioning equipment. Comply with UL 813.

B. Expansion Capability: Increase number of stations in the future by percent above those indicated without adding any internal or external components or main trunk cable conductors.

C. Integration: Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

D. Local Area Network: The system will utili□e a LAN for the connectivity of all devices and components within the facility for the transmission of electronic data. The LAN will be an expansion to the existing or a separate standalone structure in support of the intercommunication system as dictated by the project design documents.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.

F. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Administrative Console:

1. Communicating selectively with other administrative and speaker-microphone stations by dialing station's number on a 12-digit keypad.
2. Communicating with individual stations in privacy.
3. Communicating on a minimum of three voice channels with up to two simultaneous conversations between administrative consoles and one conversation between an administrative console and a speaker-microphone station.

4. Increasing the number of conversation channels by adding a module in central-control cabinet.
5. Include up to three other station connections in a conference call.
6. Access separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
7. Display indicates selected station, originating station call, all-call, □one page, normal or emergency status of call(s), and time/date.
8. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
9. Automatic control of gain to ensure constant intercom speech level.
10. Controlling simultaneous distribution of program material to various combinations of speaker-microphone stations or groups over two program channels by using keypad to control sources and distribute programs.
11. Operating and controlling class-change signals to speakers and bells by using keypad.
12. User-programmable features include the following:

    a. Station calling by room number.
    b. Room station call-in priority levels.
    c. Audible signal schedule functions.
    d. Schedule characteristics of audible signals.
    e. Call-in tone characteristic.
    f. Grouping of rooms and speakers into □ones for paging and program distribution purposes.

B. Speaker-Microphone Station:

1. Remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling administrative console by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 ADMINISTRATIVE CONSOLE FOR MICROPROCESSOR-SWITCHED SYSTEMS

A. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.

B. Volume Control: Regulates incoming-call volume.

C. Tone Annunciation: Momentary audible tone signal announces incoming calls.

D. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.

E. Speaker Microphone: Transmits intercom voice signals when used via a voice-operated switch.

1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.

F. Hard Buttons: To transfer and place calls on hold.

G. Reset Control: Cancels call and resets system for next call.

H. Digital Display: 16-digit alphanumeric LCD readout to register up to four three-digit station numbers.

I. Central-Equipment Cabinet: Comply with EIA/ECA-310-E. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.5 CALL CONTROL CONSOLE

A. Microprocessor-based instrument to process outside and internal calls with a 12-digit keypad selector.

B. 20-character alphanumeric display for the following:

1. Simultaneous display of up to three calling stations plus last station dialed.
2. Display of calls in order received with emergency calls taking precedence on the display.
3. Review of calls stored in groups of four.
4. Display of prompt messages to assist in system operation.

C. Programmable Keys: Minimum of 20 with LED indicators for ringing/busy status; programmable for trunk and operator functions.

D. Transfer Button: Calls to busy extensions and unanswered calls automatically returned to call control console.

E. Hold Button: With reminder feature every 30 seconds for parked calls or calls placed on hold.

F. Release Button: For use with parked calls or calls placed on hold.

G. Page Button: For engaging system paging functions.

H. Programmable for night answer, remote answer, and remote pickup features.

I. Programmable for distribution of emergency announcements, all-page announcements, one-page announcements, and emergency/evacuation alert.

J. Central-Control Cabinet Equipment: Central switching equipment, central office adapter module, line link modules, power supplies, chassis adapters, and other switching and control devices required for trunk and internal conversation channels and control functions.

2.6 STAFF TELEPHONE STATIONS

A. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.

B. Enclosure: Galvanized steel with 2-1/2-inch minimum depth.

C. 12-Digit Keypad: Input device to initiate calls and commands.

D. Volume Control: Regulates incoming-call volume.

E. Tone Annunciation: Momentary audible tone signal announces incoming calls.

F. LED Annunciation: Identifies calling stations and stations in use. Lamp remains on until call is answered.

G. Speaker Microphone: Transmits intercom voice signals when used via a voice-operated switch.

1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.

H. Handset with Hook Switch: Telephone type with 18-inch-long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

2.7 SPEAKER-MICROPHONE STATIONS

A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.

B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.

C. Enclosure: Two-gang galvanized steel with 2-1/2-inch minimum depth.

D. Speaker: Minimum axial sensitivity shall be 91 dB at one meter, with 1-W input. Voice coil shall be not less than 3 inches, 2.3 oz. minimum; permanent magnet.

E. Tone Annunciation: Recurring momentary tone indicates incoming calls.

F. Call Switch: Mount on faceplate. Permits calls to administrative console.

G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.

2.8 CALL-SWITCH UNIT

A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.

B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.

C. Enclosure: Single-gang box with stainless-steel faceplate.

D. Call Switch: Momentary contact signals system that a call has been placed.

E. Privacy Switch: Prevents transmission of sound signals from station to system.

F. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.

2.9 ALL-CALL AMPLIFIER

A. Output Power: 70-V balanced line. [illegible] for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.

B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.

C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

D. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 H□

E. Output Regulation: Maintains output level within 2 dB from full to no load.

F. Input Sensitivity: Compatible with administrative console and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on administrative console, speaker microphones, or handset transmitters.

G. Amplifier Protection: Prevents damage from shorted or open output.

2.10 INTERCOMMUNICATION AMPLIFIER

A. Minimum Output Power: 15 W; adequate for all functions.

B. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.

C. Minimum Signal-to-Noise Ratio: 50 dB, at rated output.

D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 H□

E. Output Regulation: Maintains output level within 2 dB from full to no load.

F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on microphones in administrative console, speaker microphones, or handset transmitters.

G. Amplifier Protection: Prevents damage from shorted or open output.

2.11 PAGING AMPLIFIER

A. Input Voltage: 120-V ac, 60 H□

B. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 H□

C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

D. Total Harmonic Distortion: Less than 3 percent at rated output power from 70 to 12,000 H□

E. Output Regulation: Less than 2 dB from full to no load.

F. Controls: On-off, input levels, and low-cut filter.

G. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.

H. Amplifier Protection: Prevents damage from shorted or open output.

2.12 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

A. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.

B. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 H□.

C. Minimum Dispersion Angle: 100 degrees.

D. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

E. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.

F. Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum □□□□□□□ □□ □ □□□□□ □□□□□ □□□ □□□□□□□□□□ □ □□□ □□□□□□□□□ □ □□□ □□□□□□ □□□□□□□□□□ .

G. Vandal-Proof, High-Strength Baffle: For □□□□ □□□□□□ -mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.

H. Si□e: 8 inches with 1-inch voice coil and minimum 5-o□ ceramic magnet.

2.13 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

A. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.

B. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 H□.

C. Minimum Power Rating of Driver: 15 W, continuous.

D. Minimum Dispersion Angle: 110 degrees.

E. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

2.14 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Si□es as recommended by system manufacturer, but no smaller than No. 22 AWG.

B. Insulation: Thermoplastic, not less than 1/32 inch thick.

C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.

1. Minimum Shielding Coverage on Conductors: 60 percent.

D. Plenum Cable: Listed and labeled for plenum installation.

2.15 RACEWAYS

A. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements in Section 270528 "Pathways for Communications Systems."

B. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements for electrical branch circuits specified in Section 270528 "Pathways for Communications Systems."

C. Educational Intercommunication and Program System Raceways and Boxes:

1. Raceways: EMT.
2. Boxes:

a. NEMA 3R for weatherproof locations.

3. Faceplates:

a. Stainless steel with Torx screws for all exposed fasteners.

4. Outlet boxes shall be not less than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

D. Flexible metal conduit is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Section 260533 "Raceways for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with hori□ontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
2. Suspend cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than □□□□□ apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Mounting of Stations: Surface mount at 54 inches above finished floor to center of station unless otherwise indicated.

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Section 260526 "Grounding and Bonding for Communications Systems."

3.6 SYSTEM PROGRAMMING

A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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

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

D. Perform tests and inspections with the assistance of a factory-authorized service representative:

E. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Test originating station-to-station, all-call, and page messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
4. Frequency Response Test: Determine frequency response of two transmission paths, including all-call and paging, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

    a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at paging speakers.
    b. Repeat test for three speaker microphones, and one administrative console microphone, and for each separately controlled zone of paging loudspeakers.
    c. Minimum acceptable ratio is 45 dB.

6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom [illegible]. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.

7. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 H□ Maximum variation in power output at these frequencies is plus or minus 3 dB.
8. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Section 270526 "Grounding and Bonding for Communications Systems."

F. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.

G. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Engage a factory-authori□ed service representative to perform startup service and initial system programming.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

A. On-Site Assistance: Engage a factory-authori□ed service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

B. Occupancy Adjustments: When requested within months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to □□ □ visits to Project during other-than-normal occupancy hours for this purpose.

3.10 DEMONSTRATION

A. Engage a factory-authori□ed service representative to train Owner's maintenance personnel to adjust, operate, and maintain the educational intercommunications and program systems.

1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment.

END OF SECTION 275123

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM

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. Addressable fire alarm control panel.
2. Addressable manual fire alarm boxes.
3. Addressable system smoke detectors.
4. Notification appliances.
5. Remote fire alarm annunciator panel.
6. Addressable interface device.
7. Digital alarm communicator transmitter.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire alarm service only.

B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire alarm service only.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire alarm system design.
b. NICET-certified fire alarm technician, Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

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

C. Shop Drawings: For fire alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire alarm control unit.
7. Copy of NFPA 25.

H. 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: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire alarm Level III technician.

C. Source Limitations for Fire Alarm System and Components: Obtain fire alarm system from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

H. NFPA Certification: Obtain certification according to NFPA 72 by

1.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
2. Detector Bases: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.

3. Keys and Tools: One extra set for access to locked and tamperproofed components.
4. Audible and Visual Notification Appliances: One of each type installed.
5. Fuses: two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. NOTIFIER; a Honeywell company. Or approved equal.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire alarm signal initiation shall be by one or more of the following devices and systems:

   1. Manual stations.
   2. Smoke detectors.
   3. Duct mounted smoke detectors.
   4. Heat detectors.
   5. Automatic sprinkler system water flow.

B. Fire alarm signal shall initiate the following actions:

   1. Continuously operate alarm notification appliances.
   2. Identify alarm at fire alarm control unit and remote annunciators.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Unlock electric door locks in designated egress paths.
   5. Release fire and smoke doors held open by magnetic door holders.
   6. Activate alarm communication system.
   7. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
   8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
   9. Activate stairwell and elevator-shaft pressuri□ation systems.
   10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
   11. Recall elevators to primary or alternate recall floors.
   12. Activate emergency lighting control.
   13. Activate emergency shutoffs for gas and fuel supplies.
   14. Record events in the system memory.
   15. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

   1. Valve supervisory switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

   1. Open circuits, shorts, and grounds in designated circuits.
   2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   3. Loss of primary power at fire alarm control unit.

4. Ground or a single break in fire alarm control unit internal circuits.
5. Abnormal ac voltage at fire alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire alarm control unit or annunciator.
9. Fire pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE ALARM CONTROL PANEL

A. General Requirements for Fire Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

   a. Initiating Device Circuits: Style D.
   b. Notification Appliance Circuits: Style Z.
   c. Signaling Line Circuits: Style 6.
   d. Install no more than 50 addressable devices on each signaling line circuit.

2. Serial Interfaces: Two RS-232 ports for printers.

D. Smoke Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire alarm control unit indication and system reset if the alarm is not verified.

E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire alarm control unit.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different □ones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.

    a. Allow the application of and evacuation signal to indicated number of □ones and, at same time, allow paging to the other □ones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire alarm control unit.

2. Status Annunciator: Indicate the status of various alarm speaker □ones and the status of firefighters' two-way telephone communication □ones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

H. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify □one, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

L. All fire alarm wiring shall be installed in conduit. All wiring methods and conduit runs shall comply with Section 16130 – Raceway and Boxes

M. All fire alarm wiring shall be UL listed for use as a fire protective signaling system.

2.4 MANUAL FIRE ALARM BOXES

A. General Requirements for Manual Fire Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated.
7. Retain subparagraph below for analog-addressable system where remotely adjustable detectors are to be used.
8. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire alarm control unit.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Photoelectric Duct-Mounted Smoke Detector: The detector housing shall be UL listed specifically for use in air handling system. Provide duct-mounted sample tube with detector. For each duct-mounted smoke detector provide a remote status/test switch mounted on the ceiling below the unit.

C. Intelligent Thermal Detectors:

1. Provide addressable, fixed temperature 135 degrees F detectors where indicated. Utilize 200 degree F detectors in kitchen area.

2.6 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Speakers: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. The audible portion of the device shall have a sound output level of at least 90 dBA measured at 10 feet from the device. This visual portion of the devices shall meet the requirements of the American’s with Disability’s Act and the Texas Accessibility Standards. Minimum candela level for the strobe light intensity shall be 75 and the flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz. The maximum flash duration shall be two-tenths of one second. It is the Contractor’s responsibility to provide additional amplifiers, speaker, wire and conduit to meet all requirements of NFPA.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

   a. 75 cd.
   b. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchroni□ed with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.7 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire alarm control unit, including acknowledging, silencing, resetting, and testing.

   1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LCD screen indicating shall match those of fire alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.8 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

   1. Verification that both telephone lines are available.
   2. Programming device.
   3. LED display.
   4. Manual test report function and manual transmission clear indication.
   5. Communications failure with the central station or fire alarm control unit.
   6.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire alarm equipment.

B. Equipment Mounting: Install fire alarm control unit on concrete base with tops of cabinets not more than 72 inches above the finished floor.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

H. Audible Alarm-Indicating Devices: Install 80 inches above finished floor or 6 inches below the ceiling as required by ADA/ADAAG. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

I. Visible Alarm-Indicating Devices: Install 80 inches above finished floor or 6 inches below the ceiling as required by ADA/ADAAG.

J. Fire Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

K. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire protection systems related to doors in fire rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressuri□ation systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire pump engine control panel.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire alarm control unit.

3.4 GROUNDING

A. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

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

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authori□ed service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

END OF SECTION 283111

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SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on CMaR's use of site and premises.

B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

D. Section 024100 - Demolition: Removal of built elements and utilities.

E. Section 312200 - Grading: Topsoil removal.

F. Section 312323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 017000.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Do not remove or damage vegetation beyond the limits indicated on drawings.

D. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
   1. At vegetation removal limits.
   2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.

E. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

F. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.

G. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.

H. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 311000

SECTION 312200 - GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal and storage of topsoil.

B. Rough grading the site for site structures.

C. Replacement of topsoil and finish grading.

1.02 RELATED REQUIREMENTS

A. Section 311000 - Site Clearing.

B. Section 312316 - Excavation.

C. Section 312316.13 - Trenching: Trenching and backfilling for utilities.

D. Section 312323 - Fill: Filling and compaction.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with City of Gordon, Public Works Department standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Topsoil excavated on-site.
   1. Graded.
   2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter, complying with State of Texas Highway Department Standards .

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

E. Protect site features to remain, including but not limited to existing structures, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil .

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

G. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

D. Place topsoil in areas where seeding are indicated.

E. Place topsoil where required to level finish grade.

F. Place topsoil to the following compacted thicknesses:
   1. Areas to be Seeded with Grass: 6 inches.

2. Areas to be Sodded: 4 inches.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants and buildings spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

L. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

A. See Section 312323 for compaction density testing.

3.09 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 312200

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SECTION 312316.13 - TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities within the building .

1.02 RELATED REQUIREMENTS

A. Document G21-2350 by D&S Engineering Labs, LLC: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 312200 - Grading: Site grading.

D. Section 312316 - Excavation: Building and foundation excavating.

E. Section 312323 - Fill: Backfilling at building and foundations.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).

D. ASTM D2940/D2940M - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports 2020.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where designated by Owner.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site and blended
   1. Graded.
   2. Free of lumps larger than 2 inches, rocks larger than 2 inches, and debris.
   3. Complying with ASTM D2487 Group Symbol GW, GP, GM, SW, SP and SM.

B. Structural Fill: see Structural Drawings & GeoTechnical Report.

C. Concrete for Fill: See Section 033000; compressive strength of 3000 psi.

D. Granular Fill - Gravel - Fill Type Bedding Course: natural stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with ASTM D2487 Group Symbol SW, SP, and SM.
   2. Graded in accordance with ASTM D2940 / D2940M-20, within the following limits:
      a. 1 inch sieve: 100 percent passing.
      b. No. 200: 8 percent passing.

E. Sand - Fill Type Bedding Course: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
   1. Graded in accordance with ASTM C33; within the following limits:
      a. Fine Aggregate.

F. Topsoil: See Section 312200.

2.02 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 312200 for additional requirements.

C. Locate, identify, and protect utilities that remain and protect from damage.

D. Notify Owner to remove and relocate utilities.

E. Protect existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Protect plants, lawns, and other features to remain.

G. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

3.03 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove excavated material that is unsuitable for re-use from site.

H. Stockpile excavated material to be re-used in area designated on site.

I. Remove excess excavated material from site.

J. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

K. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.04 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to finish grade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 4 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 4 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving and slabs-on-grade: 95 percent of maximum dry density.
   2. At utility trenches: 85 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping and Conduits:
   1. Bedding: Use Fill Type granular fill or sand.
   2. Cover with general fill.
   3. Fill up to finish grade elevation.
   4. Compact in maximum 4 inch lifts to 85 percent of maximum dry density.

3.07 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1/2 inch from required elevations.

3.08 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1557, ASTM D2167, ASTM D6938, ASTM D2922 and ASTM D2937, as applicable.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests: minimum of one test for every 150 feet or less of trench length but no fewer than two tests.

3.09 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 312316.13

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SECTION 312316 - EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for slabs-on-grade and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

C. Reference Alternates and Unit Prices for related work.

1.02 RELATED REQUIREMENTS

A. Document D & S Engineering Report # G21-2350: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.

C. Section 024100 - Demolition: Shoring and underpinning existing structures.

D. Section 220553 - Identification for Plumbing Piping and Equipment: Underground warning tapes at underground plumbing lines.

E. Section 230553 - Identification for HVAC Piping and Equipment: Underground warning tapes at underground HVAC lines.

F. Section 260553 - Identification for Electrical Systems: Underground warning tapes at underground electrical lines.

G. Section 311000 - Site Clearing: Vegetation and existing debris removal.

H. Section 312200 - Grading: Soil removal from surface of site.

I. Section 312200 - Grading: Grading.

J. Section 312316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

K. Section 312323 - Fill: Fill materials, backfilling, and compacting.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record drawings at project closeout according to 017000 - Execution and Closeout Requirements. Show locations of installed support materials left in place, including referenced locations and depths, on drawings.

C. Field Quality Control Submittals: Document visual inspection of load-bearing excavated surfaces.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

B. Survey existing adjacent structures and improvements and establish exact elevations at fixed points to act as benchmarks.

C. Determine the prevailing groundwater level prior to excavation. If the proposed excavation extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by Architect. If the proposed excavation extends more than 1 foot into the prevailing groundwater, control groundwater intrusion with a comprehensive dewatering procedures, or as directed by Geotechnical Engineer.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 311000 for clearing, grubbing, and removal of existing debris.

C. See Section 312200 for topsoil removal.

D. Locate, identify, and protect utilities that remain and protect from damage.

E. Notify utility company to remove and relocate utilities.

F. Protect existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Protect plants and lawns to remain.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

I. See Sections 017000 and 024100 for underpinning and shoring of adjacent structures that could be damaged by excavating work.

3.03 EXCAVATING

A. Excavate to accommodate construction operations and new work as indicated on the drawings.
   1. Excavate to the specified elevations.
   2. Excavate to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work.
   3. Cut utility trenches wide enough to allow inspection of installed utilities.
   4. Hand trim excavations. Remove loose matter.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume.

E. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILLING AND BACKFILLING

A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.

B. Install underground warning tape at buried utilities .

C. See Section 312323 for fill, backfill, and compaction requirements at general excavations.

D. See Section 312316.13 for fill, backfill, and compaction requirements at utility trenches.

E. See Section 312200 for rough and final grading and topsoil replacement requirements.

3.05 REPAIR

A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 312323.

3.06 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces by Architect before placement of foundations.

3.07 CLEANING

A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 312200.

B. Remove excavated material that is unsuitable for re-use from site.

C. Remove excess excavated material from site.

3.08 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION 312316

SECTION 312323 - FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for pile caps, slabs-on-grade, site structures, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

A. Document D & S Engineering # G21-2350 : Geotechnical report; bore hole locations and findings of subsurface materials.

B. Reference Structural and Civil notes & requirements on drawings.

C. Section 033000 - Cast-in-Place Concrete.

D. Section 312200 - Grading: Removal and handling of soil to be re-used.

E. Section 312200 - Grading: Site grading.

F. Section 312316 - Excavation: Removal and handling of soil to be re-used.

G. Section 312316.13 - Trenching: Excavating for utility trenches outside the building and within the Building.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.

C. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction 2012 (Reapproved 2017).

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

E. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method 2015, with Editorial Revision (2016).

F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)) 2012 (Reapproved 2021).

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).

I. ASTM D2940/D2940M - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports 2020.

J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils 2017, with Editorial Revision (2018).

K. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus 2021.

L. ASTM D6637/D6637M - Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method 2015.

M. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2017a, with Editorial Revision (2021).

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data for Manufactured Fill.

C. Materials Sources: Submit name of imported materials source.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

1.06 QUALITY ASSURANCE

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where designated by Owner.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill - Fill type: Subsoil excavated on site or import borrow - blended.
   1. Graded.
   2. Free of lumps larger than 2 inches, rocks larger than 2 inches, and debris.
   3. Complying with ASTM D2487 Group Symbol GW, GP, GM, SW, SP, and SM.

B. Structural Fill - Fill Type Engineered: Subsoil excavated on site or import borrow. Also see Structural Drawings and GeoTechnical Report.
   1. Free of lumps larger than 2 inches, rocks larger than 2 inches, and debris.
   2. Complying with ASTM D2487 Group Symbol GW, GP, GM, SW, SP, and SM.
   3. PI less than 15 and greater than 2

C. Granular Fill - Gravel - Fill Type subbase, base, engineered, and drainage: angular crushed or natural stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with ASTM D2487 Group Symbol GW, GP, GM, SW, SP, and SM.
   2. Graded in accordance with ASTM C136/C136M, within the following limits:
      a. 1 1/2 inch sieve: 95 or 90 percent passing (subbase: 90%; base: 90%).
      b. 1 inch sieve: 90 percent passing.
      c. 1/4 inch sieve: 100 percent passing.
      d. 8 sieve: 0 to 5 percent passing.
      e. No. 200: 8 or 12 percent passing (Subbase and Engineered: 12%; Base: 8%).

D. Sand - Fill Type subbase, base, engineered, and drainage: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
   1. Graded in accordance with ASTM C33/C33M

E. Topsoil: See Section 312200.

2.02 ACCESSORIES

A. Vapor Retarder: 15 mil thick, polyethylene. - Reference Structural Drawings

2.03 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. See Section 312200 for additional requirements.

C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

D. Verify structural ability of unsupported walls to support imposed loads by the fill.

E. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to finish grade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 4 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Correct areas that are over-excavated.
1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 95 percent of maximum dry density.
2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

I. Compaction Density Unless Otherwise Specified or Indicated:
1. Under paving and slabs-on-grade: 95 percent of maximum dry density.
2. At utility trenches: 85 percent of maximum dry density.

J. Reshape and re-compact fills subjected to vehicular traffic.

K. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Structural Fill at slabs-on-grade:
1. Use structural fill.
2. Fill up to drainage course elevations.
3. Maximum depth per lift: 8 inches, compacted.
4. Compact to minimum 95 percent of maximum dry density.

C. Under Interior Slabs-On-Grade:
1. Use granular fill.
2. Depth: 4 inches deep.
3. Compact to 95 percent of maximum dry density.

D. Over Buried Utility Piping and Conduits in Trenches:
   1. Bedding: Use Fill Type granular fill or sand.
   2. Cover with general fill.
   3. Fill up to subgrade elevation.
   4. Compact in maximum 4 inch lifts to 85 percent of maximum dry density.

E. At Lawn Areas:
   1. See Section 312200 for topsoil placement.

F. At Planting Areas Other Than Lawns :
   1. See Section 312200 for topsoil placement.

G. Under Monolithic Paving :
   1. See Section 321123 for aggregate base course placed over fill.

3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1/2 inch from required elevations.

3.06 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Soil Fill Materials:
   1. Perform compaction density testing on compacted fill in accordance with ASTM D2167, ASTM D6938, or ASTM D1557, ASTM D2922, ASTM D2937, as applicable.
   2. If tests indicate work does not meet specified requirements, remove work, replace and retest.
   3. Frequency of Tests: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 square feet or less of paved area or building slab, but no fewer than three tests.
   4. Proof roll compacted fill at surfaces that will be under slabs-on-grade and paving.

3.07 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 312323

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SECTION 313116 - TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

B. Site-applied termiticide for wood, steel, and concrete.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

D. Manufacturer's Instructions: Indicate caution requirement.

E. Record and document moisture content of soil before application, date and rate of application, areas of application, and termiticide brand name and manufacturer, quantity of undiluted termiticide used, dilution methods, and volumes used.

F. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of experience and approved by manufacturer.

G. Maintenance Data: Indicate re-treatment schedule .

H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Texas.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Manufacturers:
   1. Bayer Environmental Science Corp; Premise Pro Insecticide: https://www.environmentalscience.bayer.us/pest-management-and-public-health/business-assurance/products/premise-pro.
   2. FMC Professional Solutions; Dragnet FT: www.fmcprosolutions.com/#sle.
   3. Syngenta Professional Products; Demon TC: www.syngentaprofessionalproducts.com/#sle.
   4. BASF Corporation; Termidor: https://pestcontrol.basf.us/.
   5. Substitutions: See Section 016000 - Product Requirements.

D. Mixes: Mix toxicant to manufacturer's instructions.

2.02 SITE-APPLIED TERMITICIDE

A. Site Applied Termiticide for Wood, Steel and Concrete: Borate mineral salt based, spray applied termiticide formulated for use on wood, steel, concrete and other building materials.
   1. Active Ingredient: 40% minimum disodium octaborate tetrahydrate (DOT).
   2. Carrier and Penetrant: Proprietary glycol solution.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. At Both Sides of Foundation Surface.

D. Under slabs, apply toxicant 12 hours prior to installation of vapor barrier.

E. At foundation walls, apply toxicant 12 hours prior to finish grading work outside foundations.

F. Re-treat disturbed treated soil with same toxicant as original treatment.

G. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 INSTALLATION - SITE-APPLIED TERMITICIDE

A. Comply with manufacturer's written instructions.

3.04 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect sheet materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION 313116

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SECTION 316329 – DRILLED PIERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to drilling of piers as described herein and/or as shown on the Drawings.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. C. Related Sections:
1. Section 032000 – Concrete Reinforcement.
2. Section 033000 – Cast-in-Place Concrete.
3. Geotechnical Investigation Report: Included.

1.02 REFERENCES

A. American Concrete Institute (ACI).
1. ACI 301, SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS.
2. ACI 304R, GUIDE FOR MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE.
3. ACI 305R, HOT WEATHER CONCRETING.
4. ACI 306R, COLD WEATHER CONCRETING.
5. ACI 311, ACI MANUAL OF CONCRETE INSPECTION.
6. ACI 309, STANDARD PRACTICE FOR CONSOLIDATION OF CONCRETE.
7. ACI 311, ACI MANUAL OF CONCRETE INSPECTION.
8. ACI 318, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE.
9. ACI 336.1, STANDARD SPECIFICATION FOR THE CONSTRUCTION OF END BEARING DRILLED PIERS.

1.03 SUBMITTALS

A. Reinforcement: Refer to Section 03 20 00.

B. Concrete: Refer to Section 03 30 00.

1.04 MEASUREMENT AND PAYMENT

A. The Contract sum shall include all labor, materials, overhead and profit for completing drilled piers including removal of spoil. Cost of providing and placing of casings is to be included in base Contract. If casings are not required, cost of providing, installing, and removing same will be deducted from the Contract based on unit prices specified in other sections. Top of bearing stratum shown on Contract Drawings is for estimating purposes only. Pier drilling log prepared by the Testing Laboratory shall be used to adjust the Contract amount for greater and lesser pier depths, based on the actual top of bearing stratum elevation, or greater depths due to presence of sand pockets or clay seams encountered during the drilling process. Payment will

not be made for pier penetrations into bearing stratum greater than that required by the Contract Documents, unless approved by Owner and Architect.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcement: Refer to Section 032000.

B. Concrete: Refer to Section 033000.

PART 3 EXECUTION

3.01 DRILLING

A. Schedule pier drilling so piers will be filled with concrete immediately after drilling. Fill each pier with concrete within eight (8) hours after completion of drilling of same.

B. Drill piers with power auger foundation drilling equipment designed for that purpose. Locate piers to within one inch (1") maximum tolerance horizontally in any direction. Drill piers to size and depth shown, vertically, with maximum acceptable tolerance from plumb in any shaft, measured in center of shaft, not to exceed one inch (1") in any ten feet (10') with a maximum of two inches (2"). Piers drilled outside of maximum tolerance will be rejected.

C. If caving or substantial amounts of ground water are encountered, use casings to prevent caving and exclude water. Install casing sufficient distance into bearing strata to insure watertight seal.

D. If sand pockets or clay seams are encountered at the bottom of the pier hole, the pier depth must be increased to avoid bearing the pier within the sand or clay layer. The amount of increase in the pier depth shall be determined on an individual basis for each pier, and as recommended by the geotechnical engineer present on site during the drilling operation.

3.02 PUMPING AND CLEANING

A. After pier holes have been drilled to proper depth and cutting edge of casing is seated, if required, pump water out.

B. Clean bottom of pier excavations of loose material and foreign matter and receive approval of Testing Laboratory before depositing concrete.

3.03 PLACING REINFORCING STEEL AND CONCRETE

A. Do not place steel or concrete until pier holes have been inspected and approved by Testing Laboratory.

B. Maintain minimum three-inch (3") clearance between bottom of excavation and sides of excavation and reinforcement.

C. Pier reinforcing steel shall be properly positioned within the drilled shaft by a positive recognized means, equal to Centraligner® Pier Sleds manufactured by PIERESEARCH, Arlington, Texas.

D. Provide reinforcing steel dowels as detailed or scheduled. Secure reinforcement, including dowels, in place, free of contact with sides of excavations.

E. All concrete shall be placed so as to prevent segregation. Do not allow concrete to free fall over five (5) feet; provide tremie, chutes or other means of conveyance when drop exceeds this amount.

3.04 REMOVAL OF CASING

A. Prior to breaking seal between temporary casing and underlying strata, static head of plastic concrete shall be sufficiently above ground water and caving soils from entering hole during removal of casing. Once seal has been broken, temporary casing may be slowly removed in a vertical direction (no rotation permitted) while additional concrete is placed to top of pier.

3.05 IMPROPER INSTALLATION

A. The Contractor shall pay the cost of any and all changes due to improper installation of drilled piers. This shall include Architect's and Engineer's additional services made necessary by such failure, as well as costs for labor and materials.

3.06 FIELD QUALITY CONTROL AND TESTING

A. Soils Testing Laboratory shall make continuous inspections of pier drilling operations to determine that proper bearing stratum is obtained and utili□ed for bearing and that shafts are properly clean and dry before placing concrete.

B. Furnish complete pier log, showing pier number, date, weather conditions, ground elevation, the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, concrete truck, ticket number, water added at job site, slump, reinforcement and any and all observed irregularities, deficiencies or deviations from the Contract Documents.

C. Pier drilling shall be scheduled such that the concrete can be placed immediately after inspection.

END OF SECTION 316329

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